DISSERTATION ON

“A STUDY ON DEEP NECK SPACE INFECTIONS”

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CERTIFICATE

This is to certify that this dissertation **"A STUDY ON DEEP NECK SPACE INFECTIONS"** submitted by **Dr. C.R.K. BALAJI,** appearing for M.S. ENT. Branch IV Degree examination in March 2010 is a bonafide record of work done by him in partial fulfillment of regulations of The Tamil Nadu Dr. M.G.R. Medical University, Chennai. I forward this to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamilnadu, India.

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PROFORMA

ABBREVIATIONS

MASTER CHART

INSTITUTIONAL ETHICAL COMMITTEE CERTIFICATE

INTRODUCTION

Deep neck space infections are infections within the spatial compartments formed by the divisions of cervical fascia in the neck [48].

The pathophysiology as well as the management of deep neck space infections are based on the fascial layers and the resulting deep neck spaces. Deep neck space infections are life threatening and unique among infectious diseases for their versatility and potential for severe complications. A high index of suspicion is necessary to avoid any delay in treatment. With evolving cases of intravenous drug abusers, tuberculosis and HIV there is an increasing incidence of deep neck space infections. Aggressive monitoring and airway management is the most urgent and critical aspect of care. Appropriate antibiotic coverage and surgical drainage are mandatory .

Odontogenic infection is the prime source of infection now a days [1]. Increasing prevalence of deep neck space infections caused by odontogenic infections with poor oral hygiene [2], pharyngitis, tonsillitis, surgical trauma, intravenous drug abuse, oesophageal perforation, laryngopyocele, infected branchial and thyroglossal cyst, mastoiditis with bezold's (mastoid tip) abscess. Patients with immune dysfunction, diabetes mellitus and HIV infection are at risk of complications .

The most common symptoms are fever, sore throat, neck pain, neck swelling and other symptoms pertaining to regions involved. Nearly 40 % of infections are caused by mixed flora. Streptococcus, primarily alpha type and staphylococcus are still, the most commonly isolated organisms. There is an emergence of gram negative organisms like klebsiella pneumoniae, methicillin resistant staphylococcus aureus and Eikenella corrodens as causative organism .

Laboratory and radiological investigations are performed for planning the treatment. Treatment involves nonsurgical conservative management with broad spectrum antibiotics and surgical management . Surgical treatment involves intraoral drainage , external incision and drainage followed by tracheostomy if there is airway compromise.

AIMS OF THE STUDY

The present study on **DEEP NECK SPACE INFECTIONS** is undertaken

1. To evaluate the etiology and prevalence of the deep neck space infections in our hospital.
2. To study the distributions within sexes and various age groups.
3. To evaluate the prevalence of microorganisms found in deep neck space infections.
4. To analyse various types of investigations performed for early and effective management .
5. To study about mainstay of treatment.

REVIEW OF LITERATURE

ANATOMY

CERVICAL FASCIA

The cervical fascia is a fibrous connective tissue that envelops the neck creating the potential spaces. These cervical fascial planes enclose the neck and forms the potential head and neck spaces. These cervical fascial planes form the anatomic limitations for the spread of infection. The spread of infection is enhanced once their natural resistance is overcome. The cervical fascia is divided into superficial and deep. The deep cervical fascia is further divided into superficial, middle and deep cervical fascia.

CERVICAL FASCIAL PLANES

SUPERFICIAL CERVICAL FASCIA

The superficial cervical fascia of the head and neck covers adipose tissue, sensory nerves, superficial vessels (including the external jugular vein), lymphatics, the platysma and the muscles of facial expression. It extends from the head down to the shoulders, axilla, and thorax, and includes the superficial musculoaponeurotic system. The area within this fascial plane is not considered a deep neck space. Superficial space infections results in cellulitis, it can also form abscess with localized fluctuance, erythema, warmth, and tenderness beneath the skin and this abscess is drained by a transverse incision along Langer's lines over the area of prominence and managed with appropriate antibiotics [3].

DEEP CERVICAL FASCIA

The deep cervical fascia is divided into three layers namely superficial, middle and deep cervical fascia that envelop the contents of the head and neck and form the potential deep neck spaces.

SUPERFICIAL LAYER OF DEEP CERVICAL FASCIA

The superficial layer of deep cervical fascia surrounds the neck as it courses from the nuchal ridge ,the posterior spinous processes of the vertebrae to its anterior insertions into the sternum, hyoid, mandible and zygomatic arches. It follows a ‘‘rule of two’s,’’ splitting to envelop two muscles that cross the neck (trapezius and sternocleidomastoid), two muscles above the hyoid bone (anterior belly of the digastric and masseter), two salivary glands (submandibular and parotid) and two fascial compartments (parotid and masticator spaces). Just deep to the sternocleidomastoid, it contributes to the lateral aspect of the carotid sheath. The anterior-superior aspect of the superficial layer of deep cervical fascia forms the floor of the submandibular space as it covers the anterior belly of the digastric and mylohyoid muscles [3]. At mandible it splits, the internal layer covers the medial surface of pterygoid muscle upto skull base. Its external layer covers masseter and inserts into zygomatic arch. Inferiorly inserts into the clavicle, sternum and the acromion of the scapula .

MIDDLE LAYER OF DEEP CERVICAL FASCIA

The middle layer of deep cervical fascia encloses the anterior contents of the neck and has two divisions. The muscular division surrounds the infrahyoid strap muscles (sternothyroid, sternohyoid, and thyrohyoid) and extends from the hyoid bone down to the sternum, clavicle, and scapulae . The visceral division envelops the trachea, larynx, pharynx, oesophagus and thyroid gland that lie posterior to the strap muscles, and extends from the pharyngeal constrictor muscles and hyoid bone down into the anterior mediastinum overlying the fibrous pericardium and great vessels. The posterior-superior aspect of the middle layer of deep cervical fascia, also known as the buccopharyngeal fascia, courses around the posterior pharynx and forms the anterior wall of the retropharyngeal space. The muscular and visceral divisions of the middle layer of deep cervical fascia contribute to the anteromedial aspect of the carotid sheath [3,4]. Posteriorly it fuses with alar division of deep layer of deep cervical fascia at 2nd thoracic vertebra .

DEEP LAYER OF DEEP CERVICAL FASCIA

The deep layer of deep cervical fascia encloses the posterior contents of the neck. It originates posteriorly along the vertebral spinous processes and courses anteriorly beneath the trapezius muscle while surrounding the deep

neck musculature and vertebral column . The deep layer of deep cervical fascia divides as it reaches the longus colli muscle and anterior aspect of the vertebral bodies to form the prevertebral fascia and the alar fascia.

Anteriorly, the alar fascia forms the posterior wall of the retropharyngeal space, that extends from the base of the skull down to the level of the second thoracic vertebra. The alar fascia also serves as the anterior boundary of the danger space, which extends downward into the posterior mediastinum to the level of the diaphragm.

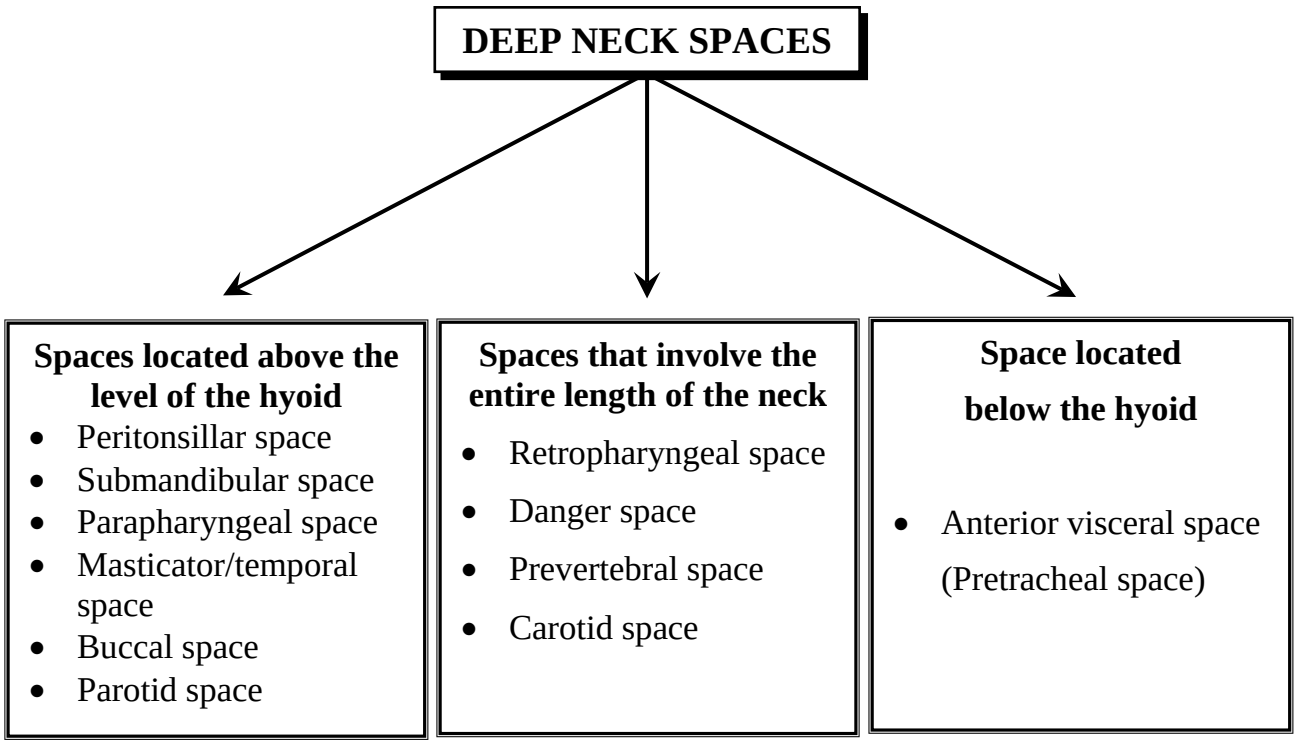
Posteriorly, the prevertebral fascia adheres directly to the vertebral bodies and cervical muscles and serves as the posterior wall of the danger space. The prevertebral space lies between the vertebral bodies and prevertebral fascia and extends from the skull base down to the coccyx. In addition to surrounding the deep neck musculature, the prevertebral fascia envelops the brachial plexus, phrenic nerve, vertebral vessels, and subclavian vessels inferiorly and eventually gives rise to the axillary sheath. The alar and prevertebral divisions of the deep layer of deep cervical fascia contribute to the posterior aspect of the carotid sheath [3,4].

CAROTID SHEATH

The carotid sheath receives connective tissue contributions from all three layers of deep cervical fascia and yet it remains anatomically independent as a barrier against the spread of infection into the carotid space from the adjacent deep neck compartments, of which the parapharyngeal space is closely related. The carotid artery, internal jugular vein, cervical sympathetic chain and the cranial nerves IX, X, XI and XII are all protected by the carotid sheath.

DEEP NECK SPACES

There are 11 deep neck spaces lying within the cervical fascial planes. As a result, the deep neck spaces are often classified into three anatomic groups based on their relation to the hyoid:



PERITONSILLAR SPACE

The peritonsillar space lies between the palatine tonsil and the adjacent superior pharyngeal constrictor muscle and is bounded anteriorly and posteriorly by the tonsillar pillars. It contains loose connective tissue, and is not generally considered a deep neck space. However, the peritonsillar space is anatomically contiguous with several deeper spaces and peritonsillar infections can potentially involve the parapharyngeal and retropharyngeal spaces. The presence of severe trismus suggests parapharyngeal space and medial pterygoid muscle involvement.

Clinical Features

Infections limited to the peritonsillar space often present with fever, sore throat, dysphagia, odynophagia, a muffled ‘‘hot potato’’ voice and cervical adenopathy.

Clinical Examination

Oropharynx may reveal tonsillar edema, visible exudates, bulging of the superior pole of the tonsillar pillar and deviation of the uvula away from the side of the infection [4].

Infections of the peritonsillar space arise from tonsillitis and are usually seen in older children [4]. Diagnosis of a peritonsillar infection is often based on clinical presentation and careful examination of the oropharynx. Less complicated infections without an obvious abscess or airway compromise are best treated with an initial course of intravenous antibiotics for 12 to 24 hours. However, it is important to distinguish cellulitis from a drainable abscess, which can be accomplished by attempting intraoral needle aspiration in cooperative patients or by using intraoral ultrasound. A contrast enhanced computed tomography scan is required when attempts fail to obtain an aspirate, in the presence of trismus, in patients who do not improve with initial antibiotic therapy , when extension into the deep neck spaces is suspected and to evaluate the need for more extensive drainage procedures. Because of a higher recurrence rate, adults with peritonsillar infections generally should be treated subsequently with tonsillectomy [5].

SUBMANDIBULAR SPACE

The submandibular space is divided into two potential spaces from the mucosal covering of the floor of the mouth down to the superficial layer of deep cervical fascia as it encloses the space between the mandible and the hyoid bone.

The mylohyoid muscle traverses the space horizontally and divides it into a supramylohyoid compartment or sublingual space and an inframylohyoid compartment or submandibular or submaxillary space. These two compartments communicate freely along the posterior aspect of the mylohyoid muscle [4]. The infections can spread to the parapharyngeal space posteriorly and the anterior visceral space inferiorly . The roots of the second and third mandibular molars lie below the attachment of the mylohyoid to the mandible and posterior dental infections can spread directly into the inframylohyoid compartment. The remaining mandibular dental roots lie above the mylohyoid line and more anterior dental infections spread directly into the supramylohyoid compartment. Other causes of infection are sialadenitis, suppurative lymphadenitis, oral trauma, and upper respiratory infections [4]. Microrganism aspirates being aerobic Streptococcus viridans, Staphylococci , anaerobic Prevotella and Peptostreptococcus species [6].

The supramylohyoid compartment (sublingual space) contains loose areolar tissue, the sublingual glands, the submandibular (Wharton's) duct, geniohyoid muscles and the lingual and hypoglossal nerves.

Clinical Features (Supramylohyoid infection)

Supramylohyoid infections present with induration, swelling, and tenderness in the floor of the mouth that often begins laterally. Protrusion and elevation of the tongue can occur as the swelling proceeds medially.

The inframylohyoid compartment (submaxillary space) contains the anterior bellies of the digastric muscles, submandibular glands and lymph nodes. In the inframylohyoid compartment ,space between the anterior bellies of the digastric muscles is the mental space .

Clinical Features (Inframylohyoid infection)

Inframylohyoid infections cause induration, swelling, and tenderness below the mandible and can progress to cause elevation and protrusion of the tongue. Infection within this compartment requires an extraoral surgical approach [3,4].

LUDWIG'S ANGINA

It is the "rapidly spreading, firmly indurated cellulitis that originates intraorally and involves [supramylohyoid and inframylohyoid compartments] bilaterally, but without abscess or lymphadenopathy," resulting in rapidly progressing upper airway obstruction [3]. In latin term 'angere' or 'to strangle' [7].

The most common cause is odontogenic, other causes are peritonsillar , parapharyngeal abscesses, epiglottitis, penetrating injuries of the floor of the mouth and diabetes mellitus with impaired immune function [7]. The infection can progress from cellulitis within the submandibular space, which can progress into fasciitis and eventually form a true abscess [8].

Clinical Features

Swelling within the enclosed submandibular space displaces the tongue superiorly and posteriorly and causes odynophagia, dysphagia, and drooling of saliva. Tongue protrusion can potentially culminate in rapidly progressive airway obstruction and asphyxiation if the airway is not urgently addressed.

In patient with impending airway obstruction, fiberoptic nasotracheal intubation may afford the best initial approach to airway management [7,8] and should be attempted with the patient sitting up right or in the semi-Fowler position, rather than supine [9].

Tracheostomy is the standard approach in Ludwig's angina patients who fail intubation. The definitive treatment of Ludwig's angina involves early airway protection and a combination of broad-spectrum antibiotics and surgical decompression of a firmly indurated submandibular space. Other complications are mediastinitis, osteomyelitis of the mandible, pleural effusion, empyema, and infection of carotid sheath structures [7].

PARAPHARYNGEAL SPACE

The parapharyngeal or lateral pharyngeal or pharyngomaxillary space, is like an inverted pyramid extending from the base of the skull down to the hyoid bone. It lies between the visceral division (pretracheal and buccopharyngeal fascia) of the middle layer of deep cervical fascia medially and the superficial layer of deep cervical fascia covering the pterygoid muscles and parotid gland laterally.

The parapharyngeal space is divided into two compartments by the styloid process and the stylohyoid, stylopharyngeus and styloglossus muscles.

The prestyloid compartment lies anteriorly and contains the internal maxillary artery, maxillary nerve and adipose tissue.

The poststyloid compartment lies posteriorly and includes the neurovascular contents of the carotid sheath containing carotid artery, internal jugular vein, cervical sympathetic chain and cranial nerves IX, X, XI and XII [4].

Parapharyngeal space infections have many sources because of the shear number of neighbouring deep neck compartments, which include the submandibular, retropharyngeal, parotid and masticator spaces. Common causes are pharyngitis, tonsillitis, otitis, mastoiditis, parotitis, cervical lymphadenitis and odontogenic infections [3,5,10].

Clinical Features

Infections of the prestyloid compartment often present clinically with fever, chills, neck pain, trismus, and anteromedial displacement of the ipsilateral palatine tonsil.

Infections of the poststyloid compartment has been known to cause little or no pain, trismus, or obvious swelling however involvement of the carotid sheath contents can lead to complications such as septicemia, Lemierre's syndrome an infective internal jugular vein thrombosis (IJVT) or carotid artery aneurysm or rupture, ipsilateral Horner's syndrome and cranial nerve IX to XII palsies. Laryngeal edema with subsequent airway obstruction is another potential sequel and may necessitate intubation or tracheostomy [3,4].

The management of parapharyngeal space infections must begin with appropriate imaging to determine if an abscess is present, the extent of its spread and its proximity and relation to the carotid sheath contents. Contrast enhanced computed tomography scan of the head and neck in combination with careful physical examination have been shown to differentiate deep neck abscess from cellulitis most accurately [11].

The poststyloid compartment infection , were much more frequent in children [12] and were likely the result of acute cervical lymphadenitis, a relatively benign condition that should respond well to an initial 48 hours of intravenous antibiotics.

The prestyloid compartment infection were common to all ages and were principally a result of dental and pharyngeal infections. Prestyloid infections caused more complications because of suppuration of the prestyloid adipose tissue and rapid diffusion of pus into other deep neck spaces including the carotid space. The prestyloid infections must be differentiated from poststyloid cervical lymphadenitis and that abscesses within the prestyloid compartment require prompt surgical drainage to avoid complications from the rapid spread of pus into adjacent deep neck spaces.

Surgical access of the parapharyngeal space has traditionally been by way of an external cervical approach, with an incision along the anterior-superior border of the sternocleidomastoid muscle to gain adequate exposure and avoid injuring the carotid sheath contents [13]. Contrast enhanced computed tomography scan has been used to identify accurately the parapharyngeal abscesses contained within the prestyloid compartment (anterior and medial to the carotid sheath) and has allowed for a less invasive transoral drainage approach to prestyloid infections. Abscesses that spread into adjacent deep neck spaces and those that involve the poststyloid compartment require an external cervical approach to incision and drainage.

MASTICATOR / TEMPORAL SPACE

The masticator space lies between the medial pterygoid muscle and the more lateral masseter muscle and is enclosed by the divisions of the superficial layer of deep cervical fascia that envelop these muscles. It extends back to the posterior aspect of the mandible and superiorly as the temporal space, to surround the temporalis muscle deep to the temporalis fascia. The contents are the temporalis muscle, the ramus of the mandible, divisions of the mandibular nerve and the internal maxillary artery. Masticator space infections originate from the posterior mandibular molars , trauma and surgery.

Clinical Features

Patients often present with severe trismus, sore throat, dysphagia, pain surrounding the ramus of the mandible and preauricular or mandibular swelling. More extensive infections can cause swelling of the entire side of the face and involvement of the orbit may lead to proptosis, optic neuritis and cranial nerve VI palsy.

The surgical approach to incision and drainage of the masticator space depends on the location of the abscess in relation to the mandible. An intraoral approach at the retromolar trigone is appropriate for draining abscesses medial to the ramus of the mandible and an extraoral approach along the inferior border of the mandible is used for draining abscesses lateral to the mandibular ramus. An incision through the temporalis fascia along the hairline is necessary to drain abscesses that spread superiorly and surround the temporalis muscle within the temporal space [3,4].

BUCCAL SPACE

The buccal space lies between the buccopharyngeal fascia overlying the buccinator muscle medially and the skin of the cheek laterally and is limited inferiorly by the border of the mandible and posteriorly by the pterygomandibular raphe. It contains the buccal fat pad, the parotid duct, and the facial artery. Most buccal space infections are odontogenic in origin and present with a warm and tender swelling within the cheek and minimal systemic symptoms. Trismus may be present if the infection spreads posteriorly to involve the masseter muscle.They are often successfully treated with antibiotics alone , if drainage required it can be done extraorally [3,4].

PAROTID SPACE

The parotid space exists within the capsule that is formed by the superficial layer of deep cervical fascia as it envelops the parotid gland. The fascia on the medial aspect of the gland is thin and provides little resistance to the spread of parotid space infections into the adjacent parapharyngeal space. The space contains the parotid gland, the facial nerve, external carotid artery, retromandibular vein, auriculotemporal nerve, superficial temporal artery and lymph nodes. Parotid space infections often result from parotid duct obstruction or suppurative lymphadenitis and occasionally originate from odontogenic infections of the mandibular molars that traverse the masticator space [3,4].

Clinical Features

The patients usually present with severe pain and swelling at the angle of the mandible, trismus if the masticator space is involved. Systemic symptoms such as fever and chills may accompany the spread of infection into the parapharyngeal space and other deep neck spaces. An external, parotidectomy-like approach is used to drain a parotid space abscess and blunt dissection, either superior or inferior to the posterior belly of the digastric muscle, allows concurrent drainage of the parapharyngeal space when it is involved [3,4].

RETROPHARYNGEAL SPACE

The retropharyngeal (retrovisceral) space lies between the visceral (buccopharyngeal) fascia covering the posterior pharynx and oesophagus and the alar fascia, a division of the deep layer of deep cervical fascia and occupies the space posterior to the pharynx and esophagus. It extends from the base of the skull down into the mediastinum where the visceral and alar fascias fuse at the level of the second thoracic vertebra. Laterally, it is bounded by the carotid sheaths. The retropharyngeal space is fused in the midline and contains two chains of lymph nodes extending down each side. Retropharyngeal abscesses are unilateral as a result of the midline fusion and are primarily seen early in childhood because these lymph nodes tend to regress with age.

Retropharyngeal infection in adults is usually due to trauma to the posterior pharyngeal wall or as an extension from an adjacent parapharyngeal space infection [14]. Cultures of retropharyngeal aspirates are generally polymicrobial and contain common oropharyngeal flora such as Streptococcus viridans and other species of Streptococcus and Staphylococcus aureus [5].

Clinical Features

In retropharyngeal abscess , patients present with neck pain, fever, anorexia , dyspnoea and other constitutional symptoms [3].

Clinical Examination

An unilateral bulge of the posterior pharynx, which is localized in retropharyngeal lymphadenitis and may extend the length of the pharynx when cellulitis or an abscess is present. In the absence of acute distress, contrast enhanced computed tomography scan of the head and neck can be used to confirm the diagnosis and evaluate for spread of infection into adjacent deep neck spaces [4].

The life threatening complications of retropharyngeal infection are airway obstruction and rupture of an abscess with subsequent aspiration of pus. Patients who have signs of airway compromise should be taken immediately to the operating room before being examined. With the patient in the head down position and intubation along the opposite side of the pharynx from the swelling, needle aspiration should precede intraoral incision and drainage to

obtain specimens for culture and sensitivity and to minimize any risk of the patient aspirating pus during the procedure. Small vertical incision made in the lateral aspect of the posterior pharyngeal wall at a point between the junction of lateral one third and medial two third of the distance between midline of the pharynx and medial aspect of retromolar trigone .The space is probed gently with a hemostat to break up the loculation and drain the abscess. Spread of the infection into the parapharyngeal space may necessitate an external cervical approach to incision and drainage if the involvement is not confined to the prestyloid compartment medial to the great vessels [4].

DANGER SPACE

The danger space lies posterior to the retropharyngeal space between the alar and prevertebral fascias, the two divisions of the deep layer of deep cervical fascia and extends from the skull base down into the posterior mediastinum to the level of the diaphragm. Infections result from the spread of retropharyngeal, parapharyngeal, and prevertebral space abscesses. There is tendency for infections to spread inferiorly through the space and into the thorax because the loose areolar contents offer little resistance, resulting in complications such as mediastinitis, empyema, and sepsis. Danger space infections initially present in the same way as retropharyngeal infections and contrast enhanced computed tomography scan is necessary to differentiate between them [3].

PREVERTEBRAL SPACE

The prevertebral space is a potential space between the prevertebral fascia and the underlying vertebral bodies and deep cervical musculature. It extends down the entire length of the vertebral column to the coccyx. However, dense fibrous attachments between the prevertebral fascia and deep cervical muscles tend to contain prevertebral infections and help prevent longitudinal spread. Sources of infection are trauma to the posterior pharynx, secondary spread from Pott's abscesses , retropharyngeal and danger space infections.

Clinical Features

Patients often present with a midline bulge in the posterior pharynx. Complications include osteomyelitis and spinal instability, which require a prolonged course of antibiotics. Once identified with contrast enhanced computed tomography scan, prevertebral space abscesses should be drained using an external cervical approach rather than an intraoral approach, which can lead to a persistent draining fistula in the posterior pharynx [4].

CAROTID SPACE

The carotid (visceral vascular) space lies within the carotid sheath and contains the carotid artery, internal jugular vein, cervical sympathetic chain, and cranial nerves IX, X, XI, and XII. It also contains areolar tissue.

Lincoln's highway suggests, the carotid sheath receives contributions from all three layers of deep cervical fascia, extends from the base of the skull into the mediastinum, and can potentially serve as a highway for infectious spread originating in any deep neck space. In addition to secondary spread from adjacent deep neck spaces, direct inoculation into the neck in intravenous drug abusers and iatrogenic causes such as central venous catheterization can lead to carotid space infections [3,4].

Clinical Features

Patients often presents with stiffness and ipsilateral swelling of the neck, fever, chills, ipsilateral Horner's syndrome, vocal cord paralysis, and other complication-related findings. Internal Jugular Vein Thrombus can cause intermittent spiking fever and carotid artery rupture may be preceeded by sentinel bleeds from the ear, nose, or mouth. An external cervical approach is used for incision and drainage of the carotid space [3,4].

ANTERIOR VISCERAL SPACE

The anterior visceral or pretracheal space lies below the hyoid bone. It is bounded by the visceral division of the middle layer of deep cervical fascia and lies between the infrahyoid strap muscles and the oesophagus. It contains the thyroid gland, the trachea, and the anterior wall of the oesophagus and extends from the thyroid cartilage down into the superior mediastinum overlying the aortic arch and fibrous pericardium. The anterior visceral and retropharyngeal spaces are separated by lateral attachments of the oesophagus to the prevertebral fascia beginning at the level of the thyroid gland, so that the anterior visceral space lies anterior and the retropharyngeal space lies posterior to the oesophagus [4].

The etiology of the anterior visceral space infection are the traumatic perforation of the anterior oesophageal wall , neck trauma and thyroiditis.

Clinical Features

Patient complains of neck swelling, sore throat, dysphagia, hoarseness, and dyspnoea as a result of pharyngeal, laryngeal, and supraglottic edema, which can potentially progress to airway compromise.

Clinical Examination

The examination finding suggestive of crepitation of the anterior neck, mediastinitis, and pneumothorax [4] are the significant evidence of perforation of the esophagus (the visceral contents). Abscesses in the anterior visceral space require an external cervical approach for incision and drainage .

EVALUATION AND DIAGNOSING DEEP NECK SPACE INFECTION

Appropriate history, proper meticulous physical examination, relevant laboratory work and diagnostic imaging are important for evaluation and diagnosis . Assessment of the airway is important and any signs of impending airway compromise should be immediately and aggressively managed.

History of Patient

Insight into the recent illness (pharyngitis , tonsillitis etc) ,dental caries , dental procedures, trauma to the head and neck and intravenous drug use or drug abuse. Patients with diabetes mellitus, HIV infection, steroid therapy, chemotherapy, and patient with immune dysfunction should be diagnosed early and appropriately managed to minimize potential complications.

Examination

Patients present more commonly with pain and swelling of the neck, odynophagia [16], fever, dysphagia, trismus, dysphonia, otalgia, and dyspnoea [15]. In the pediatric population, fever, neck mass and neck stiffness were most prevalent, followed by sore throat, poor oral intake, drooling, and lymphadenopathy [17].

Laboratory Investigation

Patients are investigated with complete blood count with differential, serum glucose and electrolytes, coagulation studies (prothrombin time, partial thromboplastin time), HIV screening in adults , blood cultures and appropriate cultures of aspirates. Anaerobic cultures should be placed immediately into an oxygen-free container. aerobic and anaerobic cultures, fungal and acid-fast cultures are recommended for immunocompromised patients [15]. Leukocytosis is important feature in abscess [11].

DIAGNOSTIC IMAGING

Plain Radiograph

Chest radiographs are useful for screening complications like mediastinitis, pneumonia and pleural effusion [18]. Lateral neck radiographs are useful for screening retropharyngeal and parapharyngeal abscesses. Dental radiographs such as the Panorex oral view are useful in identifying odontogenic sources of infection [3].

Computed Tomography Scan

Computed tomography scan helps in identifying the spaces involved, aiding in the early recognition of complications and planning the surgical approach [19]. It identifies impeding airway complications. Neck swelling that extends to the suprasternal notch may indicate involvement of the mediastinum

and chest screening is mandatory [11,17]. When combined with careful clinical examination diagnosis can be done accurately. It can differentiate from frank cellulitis to abscess. A discrete hypodensity greater than 2 mL in volume is more predictive of a deep neck abscess than the presence of a ring-enhancing lesion [11] .It can diagnose mediastinitis accurately [20].

Ultrasonography

Ultrasound can differentiate a drainable abscess from cellulitis [4]. It is portable, inexpensive, promptly available in most of the institutions and avoids exposure to radiation. It helps to guide diagnostic and therapeutic needle or catheter aspiration of superficial, uniloculated fluid collections when imminent airway compromise is not evident [4].

Magnetic Resonance Imaging

It provides better soft tissue definition, avoids exposure to radiation and interference from dental fillings [3]. Magnetic resonance angiography useful in evaluating vascular complications such as Internal Jugular Vein Thrombus and carotid artery aneurysm or rupture [15].

AIRWAY MANAGEMENT

Acute airway obstruction is one of the most deadly complications of deep neck space infections [21,22]. It can be encountered in multiple space involvement, Ludwig's angina, retropharyngeal, parapharyngeal and anterior visceral space abscesses. Tracheostomy under local anaesthesia is safe and effective for managing airway compromise [23]. Other methods of airway management are endotracheal intubation, fiber optic nasotracheal intubation, and cricothyrotomy [24,25].

Monitoring the airway is the first priority [15]. Indications for aggressive airway management are the signs of respiratory distress (dyspnoea, stridor, chest retractions) or impending airway compromise as noted on physical examination or diagnostic imaging (severe swelling within the pharynx, upward displacement of the tongue, airway oedema or airway compression by an abscess). Intravenous steroids [24] in patients with impending airway obstruction can minimize swelling and reduce the need for aggressive airway intervention . Systemic steroids have hyperglycemic effects and should be avoided in patients who have diabetes mellitus or poor glucose control [26].

Tracheostomy

The tracheostomy under local anesthesia is indicated for severe or impending airway obstruction .Incisions are made separately for tracheostomy

and drainage procedures.Tracheostomy is avoided in case of anterior visceral space / pretracheal space infection [15]. The advantages are airway security , decreased sedation ,short hospital stay and decrease mortality [27]. The disadvantages are bleeding , pneumothorax tracheal stenosis , mediastinitis , aspiration of pus , rupture of innominate artery and death [24].

Endotracheal Intubation

Endotracheal intubation can be attempted before tracheostomy for patients with deep neck space infections. The advantages of endotracheal intubation are fast airway control and avoidance of the risks associated with a surgical procedure [26]. The disadvantages are difficulty in the presence of airway edema, patient discomfort, a less secure airway, greater need for patient sedation and mechanical ventilation, potential for laryngotracheal stenosis, unplanned extubation is the most common complication of endotracheal intubation and longer hospital stay [27].

Fiber Optic Nasotracheal Intubation

Fiber optic nasotracheal intubation can be performed using topical anaesthesia. It is especially useful in patients who have severe trismus but whose airways are otherwise uncompromised .Procedure is difficult in edema, copious secretions, inadequate experience and improper application of topical anaesthetic [25].

Cricothyrotomy

Cricothyrotomy can provide urgent airway access when complete loss of the airway necessitates immediate surgical intervention. The rigid nature of the thyroid and cricoid cartilages limits the size of the tube that can be placed to an average of 9.0 mm in diameter. Passage of the cricothyrotomy tube may cause trauma to the posterior wall of the trachea and subglottic stenosis is a potential complication. Cricothyrotomy should be converted to a standard tracheostomy within 24 to 48 hours [24].

MICROBIOLOGY

The aspirates from deep neck abscesses are commonly polymicrobial and reflect the oropharyngeal flora and odontogenic nature of these infections.

Most commonly aerobes like Streptococcus viridans, Klebsiella pneumonia and Staphylococcus aureus and less commonlly Streptococcus pneumoniae, Streptococcus pyogenes, Neisseria species and Haemophilus influenzae.

Most common anaerobic isolates include Peptostreptococcus, Bacteroides fragilis, pigmented Prevotella and Porphyromonas species, Fusobacterium species and Eikenella corrodens [28,29]. Eikenella corrodens sensitive to penicillin and aminoglycosides [30].

Anaerobic bacterias are increasingly penicillin resistant because of production of b-lactamase which is released into the infection and has a protective effect for nearby penicillin-sensitive species.

Methicillin resistant staphylococcus aureus causes nosocomial infections, deep neck space infections in intravenous drug abusers [31], immunocompromised patients, infants and young children . It is an emerging pathogen in necrotizing fasciitis and descending mediastinitis [32].

Klebsiella pneumoniae is consistently the most common cause of deep neck space infection in patients who have poorly controlled diabetes mellitus [23,30].

EMPIRICAL ANTIBIOTIC COVERAGE

Patient with deep neck space infection should be given an initial empirical antibiotic therapy until culture and sensitivity results are available. Empiric therapy should be effective against the aerobic and anaerobic bacteria that are commonly involved. Either penicillin in combination with a b-lactamase inhibitor (such as amoxicillin or ticarcillin with clavulanic acid) or a b-lactamase–resistant antibiotic (such as cefoxitin , cefuroxime , imipenem, or meropenem) in combination with a drug that is highly effective against most anaerobes (such as clindamycin or metronidazole) is recommended for optimal empiric coverage. Vancomycin [30] should be considered for empiric therapy

in intravenous drug abusers at risk for infection with Methicilin resistant staphylococcus aureus and in patients who have profound neutropenia or immune dysfunction [31]. Ceftriaxone and clindamycin can be used as empiric therapy against community-acquired methicilin resistant staphylococcus aureus in young children to ensure adequate coverage and avoid resistance to vancomycin . The addition of gentamicin for effective gram-negative coverage against Klebsiella pneumoniae, which is resistant to clindamycin, is highly recommended for diabetic patients [33], renal function should be closely monitored whenever aminoglycosides are administered to patients at risk for renal disease. Parenteral antibiotic therapy should be continued until the patient has been afebrile for at least 48 hours, followed by oral therapy using amoxicillin with clavulanic acid, clindamycin, ciprofloxacin, trimethoprim-sulfamethoxazole or metronidazole [3,28].

CONSERVATIVE MEDICAL MANAGEMENT

Uncomplicated deep neck abscess or cellulitis can be effectively treated with antibiotics and careful monitoring without surgical drainage [34]. Medical treatment for associated comorbidities such as diabetes can improve the overall immune status of a deep neck space infection patient [16]. The use of steroids along with antibiotic treatment may reduce the need for surgical intervention by minimizing airway oedema, inflammation and the progression of cellulitis into an abscess . A study by Oh [10] and associates found that 55.9% of 34

parapharyngeal space abscesses responded well to conservative medical management. . However, conservative management may not be appropriate for diabetic patients who have demonstrated a lack of response to such treatment [19]. Aspiration of an abscess for culture and sensitivity is recommended for immunocompromised patients and anyone at risk for infection with an unusual or atypical pathogen [4].

SURGICAL MANAGEMENT

Surgical management is the treatment for more complicated cases of deep neck space infection.

Indications are airway compromise, critical condition, septicemia, complications, descending infection, diabetes mellitus and no clinical improvement within 48 hours of the initiation of parenteral antibiotics [19,23].

Abscesses greater than 3 cm in diameter that involve the prevertebral or anterior visceral or carotid spaces or that involve more than two spaces should be surgically drained [19].

Surgical drainage can be a simple intraoral or extraoral incision and drainage for superficial abscesses and a more extensive external cervical approach for deeper and more complicated infections. A minimally invasive techniques such as image-guided needle aspiration and indwelling catheter

placement can be performed . Abscesses that are small and unilocular may respond well to needle aspiration whereas larger and multilocular abscesses [4] usually require incision and drainage. Aspirated pus or debrided tissue should be obtained and sent for gram stain and cultures as soon as the abscess cavity is entered. Swabs are generally avoided because they prevent accurate culturing of anaerobic bacteria from the wound. Fluid resuscitation before surgery is important in deep neck space infection patients because these patients frequently present in a dehydrated state [3].

The external cervical approach is used in draining the anterior visceral, submandibular, parapharyngeal, prevertebral ,carotid spaces and for complicated retropharyngeal abscesses that cannot be fully drained using an intraoral approach [4].

Wide exposure is required for debridement of any necrotic tissue . Wounds requiring extensive debridement should be left open and packed with antimicrobial dressings to allow for frequent inspection. Wounds with less necrosis can be closed during surgery with active suction drainage .

Minimally invasive techniques can be performed for welldefined, unilocular abscesses in patients who do not have airway compromise. Ultrasound guidance [35] is appropriate for locating and draining abscesses accessible through the skin and CT guidance is helpful when attempting needle

aspiration of a deep abscess which is difficult to access . Needle aspiration and catheter placement offer the advantages of a small point of entry, quick healing time, little or no scar formation and less risk of contaminating the surrounding deep neck spaces while draining pus. Needle aspiration was repeated within 3 days when residual purulent discharge was observed. Catheters with continuous suction were left in place for 3 to 5 days. Successful percutaneous treatment was defined by the disappearance of the abscess as documented by followup ultrasound, contrast enhanced computed tomography scan or clinical improvement. Failure of percutaneous treatment was recognized and subsequently converted to open drainage when the abscess remained unchanged or increased in size, when signs of systemic toxicity persisted or after two attempts at needle aspiration failed.

COMPLICATIONS

Mediastinal Complication

The downward extension of an infection from the spaces that extend the length of the neck or the anterior visceral space results in mediastinitis. The causative organism [20] varies depending on the origin of the infection, most cases are polymicrobial and involve both aerobes and anaerobes. Patients with mediastinitis present with increasing chest pain or dyspnoea. Chest radiography and computed tomography scan may demonstrate a widened mediastinum or pneumomediastinum . The mortality rate for patients with mediastinitis is high [23].

Vascular Complication

The internal jugular vein suppurative thrombophlebitis or lemierre's syndrome results from extension of the infection into the carotid space.The clinical features include swelling and tenderness at the angle of the jaw and along the sternocleidomastoid muscle and signs of sepsis (spiking fever and chills) [36]. Internal Jugular Vein Thrombus may be detected using high resolution computed tomography scan and magnetic resonance imaging. Treatment involves prolonged antimicrobial therapy directed by culture and sensitivity results and anticoagulation for 3 months when thrombus progression or septic emboli are present. Most cases resolve with antibiotic and anticoagulation

therapy and do not require surgical ligation and resection of the internal jugular vein [37]. Fibrinolytic agents may be used if internal jugular vein thrombosis is recognized within 4 days of onset but they carry a higher risk of hemorrhage than anticoagulation [37].

Carotid artery aneurysm or rupture may present with a pulsatile neck mass and often results in four cardinal signs:

- Recurrent sentinel hemorrhages from the pharynx or ear
- Protracted clinical course (7–14 days)
- Hematoma of the surrounding neck tissues
- Hemodynamic collapse

Early diagnosis and surgical intervention to gain proximal control of the common carotid artery and interventional radiologic procedures such as endovascular stenting or vessel occlusion are also an option in less urgent cases [15].

Necrotizing Cervical Fasciitis

Necrotizing cervical fasciitis is a fulminant infection that spreads along fascial planes and causes necrosis of connective tissues . The pathogens involved are usually polymicrobial and odontogenic and they include Streptococcus pyogenes, Clostridium perfringens, and mixed aerobes and anaerobes. Methicilin resistant staphylococcus aureus important cause and requires of vancomycin to empiric treatment of this condition [32]. Patients

who have necrotizing fasciitis are acutely ill with high fevers and the skin overlying the necrosis may be tender, oedematous and erythematous with indistinct transition to normal skin. Soft tissue crepitation due to infection with gas-producing organisms may be present and in more advanced cases the skin becomes pale, anaesthetic and dusky with blistering and sloughing [3]. Contrast computed tomography scan may demonstrate diffuse cellulitis with infiltration of the skin and subcutaneous tissues and myositis, compartmental fluid and gas accumulations [38]. Managing necrotizing fasciitis involves parenteral antibiotics along with early and frequent surgical debridement of any devitalized tissue. The wound should be left open and packed with antimicrobial dressings until the infection has subsided. Hyperbaric oxygen is useful as an adjunctive treatment in hemodynamically stable patients. The condition is often accompanied by mediastinitis and sepsis which increase the risk of mortality [39,1].

Other Complications

Lung abscess , aspiration pneumonia , empyema and asphyxiation may result when an abscess ruptures into the larynx or trachea and purulent drainage is subsequently aspirated.

Horner's syndrome and cranial nerve IX to XII palsies result from infections that invade the carotid space.

Osteomyelitis can involve the mandible or cervical vertebral bodies and can lead to vertebral subluxation . Sepsis is the direct cause of mortality in patients with deep neck space infection .

Potential complications include meningitis, intracranial abscess and disseminated intravascular coagulation [39].

RISK FACTORS

Diabetes Mellitus

Diabetes mellitus is the most common associated systemic disease in deep neck space Infection. Hyperglycemia has been found to impair neutrophil function [40,41] , impair the complement pathway and increase the virulence of certain pathogens . The immune dysfunction resulting from uncontrolled diabetes diminishes the ability to confine an infection which is evident in the frequency of multispace involvement in diabetics with deep neck space infection [42,43]. Klebsiella pneumoniae is the most frequently isolated pathogen from deep neck aspirates in diabetic patients and is effectively treated by adding gentamicin to their empiric antibiotic therapy [42,43]. Diabetics have lengthier hospitalization and surgical intervention, respond poorly to conservative medical therapy and develop complications with greater frequency compared with nondiabetic patients [43]. Therefore, management of deep neck space infection in diabetic patients should include earlier and more aggressive medical and surgical therapies and careful monitoring to maintain blood glucose levels below 200 mg/dL [42,43].

Other Immunosuppression

Immunosuppression from other sources such as HIV infection, chemotherapy, chronic renal failure, hepatic disease and chronic steroid therapy for autoimmune disease increases the risk for more severe and atypical infections of the head and neck. Immunocompromised patients are more likely to present with minimal signs and symptoms despite a greater risk for complications. Deep neck space infections may be the first clinical manifestation of an HIV infection and the laboratory work for unknown at-risk patients should include an HIV screening panel. AIDS patients who have more advanced immune dysfunction often have low or normal white blood cell counts regardless of the severity of their infections [22]. Empiric antibiotic therapy should be expanded to cover for all potential pathogens [3].

Intravenous drug abuse places a patient at risk for carotid space infection when the neck is used as an injection site. Pathogens are introduced through the skin and an abscess may form around a foreign body such as a broken needle. Appropriate empiric antibiotic coverage should include vancomycin along with adequate anaerobic coverage that is also effective against Eikenella corrodens, such as ciprofloxacin or an aminoglycoside.

Congenital cysts should be suspected in any patient who has recurrence of deep neck space infection. Congenital lesions are branchial cleft cysts, lymphangiomas, thyroglossal duct cysts and cervical thymic cysts. Infection in

any of these cysts may present similarly with a painful, tender swelling in the neck and variable degrees of overlying cellulitis. Imaging is useful in early recognition and surgical planning but definitive diagnosis requires surgical confirmation. Initially, infections within congenital cysts may respond well to antibiotic therapy. However, complete surgical excision of the cyst wall is absolutely necessary to prevent the inevitable recurrence of infection [30,44.]

Therefore, it is recommended that the workup of patients who have deep neck space infection include a careful history, a comprehensive ear, nose, and throat examination , radiological evaluation, pathologic examination and culture of aspirate obtained surgically or by needle aspiration followed by appropriate antibiotics.

MATERIAL AND METHODS

The prospective study was conducted in the Upgraded Institute of Otorhinolaryngology of Govt. General Hospital, Chennai 600003, during July 2007 – Sept 2009. The hospital caters to a population in and around Chennai and it is a major referral centre for Tamilnadu and Southern parts of India and Andaman and Nicobar islands.

A total of 130 patients with deep neck space infections were analysed during July 2007 – Sept 2009. Cases with fever, sore throat, odynophagia, dysphagia, neck swelling, neck pain, neck tenderness and change in voice were selected.

All cases under went a thorough history taking and a detailed examination. Once suspected,the cases were examined thoroughly with x-ray neck lateral and antero-posterior view, chest x-ray, computed tomography scan and microbiological studies. The patients were then started on broad spectrum antibiotics later changed to appropriate antibiotics based on culture and sensitivity . Uncomplicated neck space infection can be effectively managed by broad spectrum antibiotics. If the abscess is more than 3cm diameter according to computed tomography scan, involving peritonsillar space, prevertebral, anterior visceral , carotid spaces or that involved more than or equal to 2 spaces, they were surgically incised & drained. Other indication for surgery are airway compromise, descending infection, patients with diabetes mellitus and patients with no improvement after 48 hrs of parentral antibiotics . The deserving cases underwent open surgical procedures and management results were analysed.

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

- Patients age more than 12 years.
- All patients with manifestations of fever, neck pain, neck swelling , neck tenderness ,odynophagia, dyspnoea presented to outpatient department and casualty, on preliminary examination if suspected as deep neck space infection and confirmed with imaging study were included in this study.
- Patients willing for the study.

EXCLUSION CRITERIA

- Patients age less than 12 years
- Patients not willing for the study
- Patients associated with malignancy

RESULTS AND ANALYSIS

DEEP NECK SPACE INFECTIONS

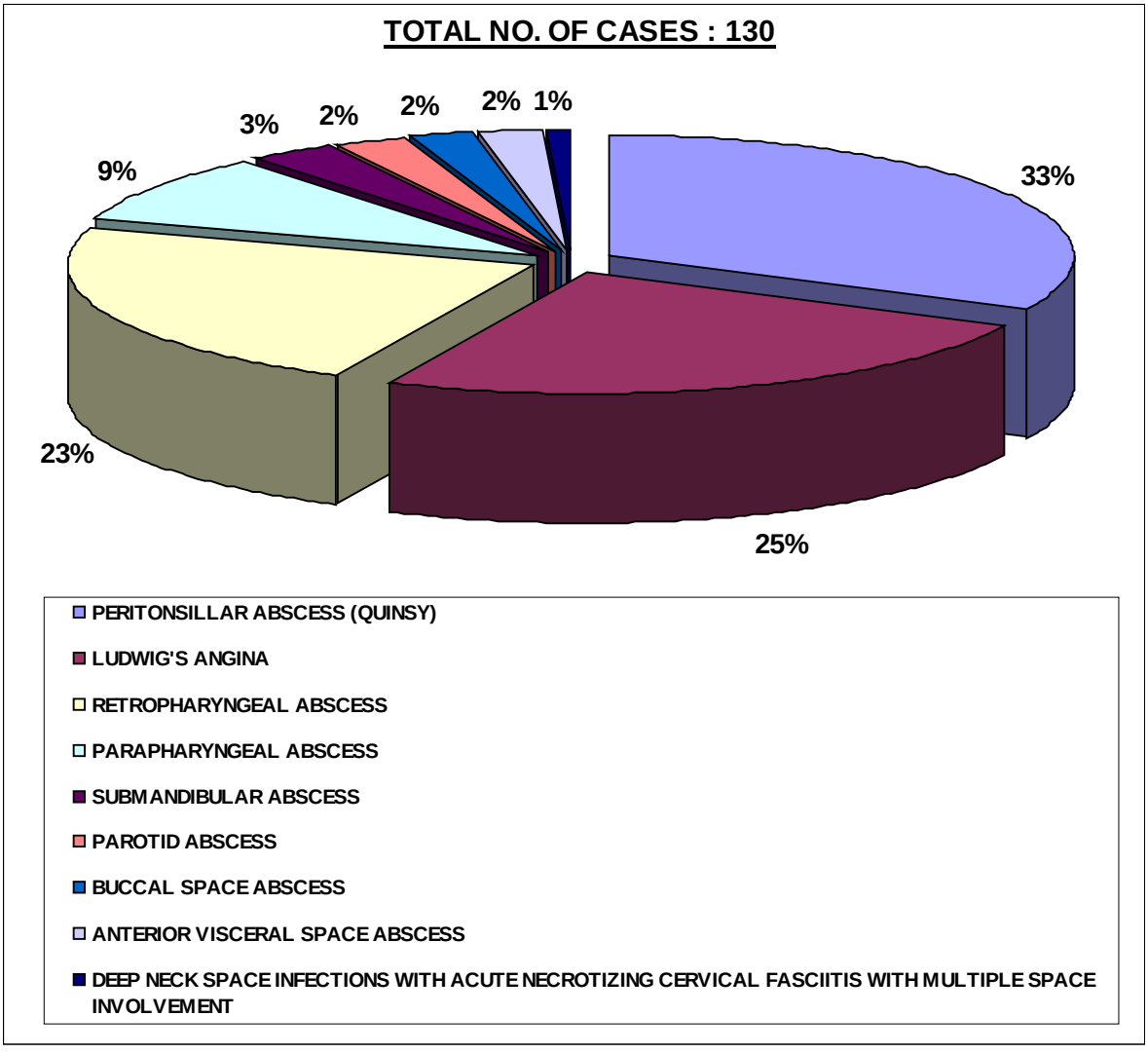
Tabular Column (1) TOTAL NUMBER OF CASES

S.No.	Deep Neck Space Infections	No. of Cases	Percentage
1	PERITONSILLAR ABSCESS (QUINSY)	42	33%
2	LUDWIG'S ANGINA	32	25%
3	RETROPHARYNGEAL ABSCESS	30	23%
4	PARAPHARYNGEAL ABSCESS	12	9%
5	SUBMANDIBULAR ABSCESS	4	3%
6	PAROTID ABSCESS	3	2%
7	BUCCAL SPACE ABSCESS	3	2%
8	ANTERIOR VISCERAL SPACE ABSCESS	3	2%
9	DEEP NECK SPACE INFECTIONS WITH ACUTE NECROTIZING CERVICAL FASCIITIS WITH MULTIPLE SPACE INVOLVEMENT	1	1% (0.76%)
	TOTAL NO. OF CASES	**130**	

Among the 130 cases of deep neck space infections the most common was peritonsillar abscess (Quinsy) followed by Ludwig's angina, retropharyngeal abscess, parapharyngeal abscess, submandibular abscess, parotid abscess, buccal space abscess, anterior visceral space abscess and acute necrotizing faciitis.

DEEP NECK SPACE INFECTIONS

Diagram (1) ***CASE PERCENTAGE***



DEEP NECK SPACE INFECTIONS AMONG MALE & FEMALE

Tabular Column (2)

Deep neck space infections	No. of Cases	
	Male	**Female**
PERITONSILLAR ABSCESS	30	12
LUDWIG'S ANGINA	17	15
RETROPHARYNGEAL ABSCESS	22	8
PARAPHARYNGEAL ABSCESS	11	1
SUBMANDIBULAR ABSCESS	3	1
PAROTID ABSCESS	1	2
BUCCAL SPACE ABSCESS	3	0
ANTERIOR VISCERAL SPACE ABSCESS	2	1
DEEP NECK SPACE INFECTION WITH ACUTE NECROTIZING FASCIITIS	1	0
TOTAL	**90**	**40**

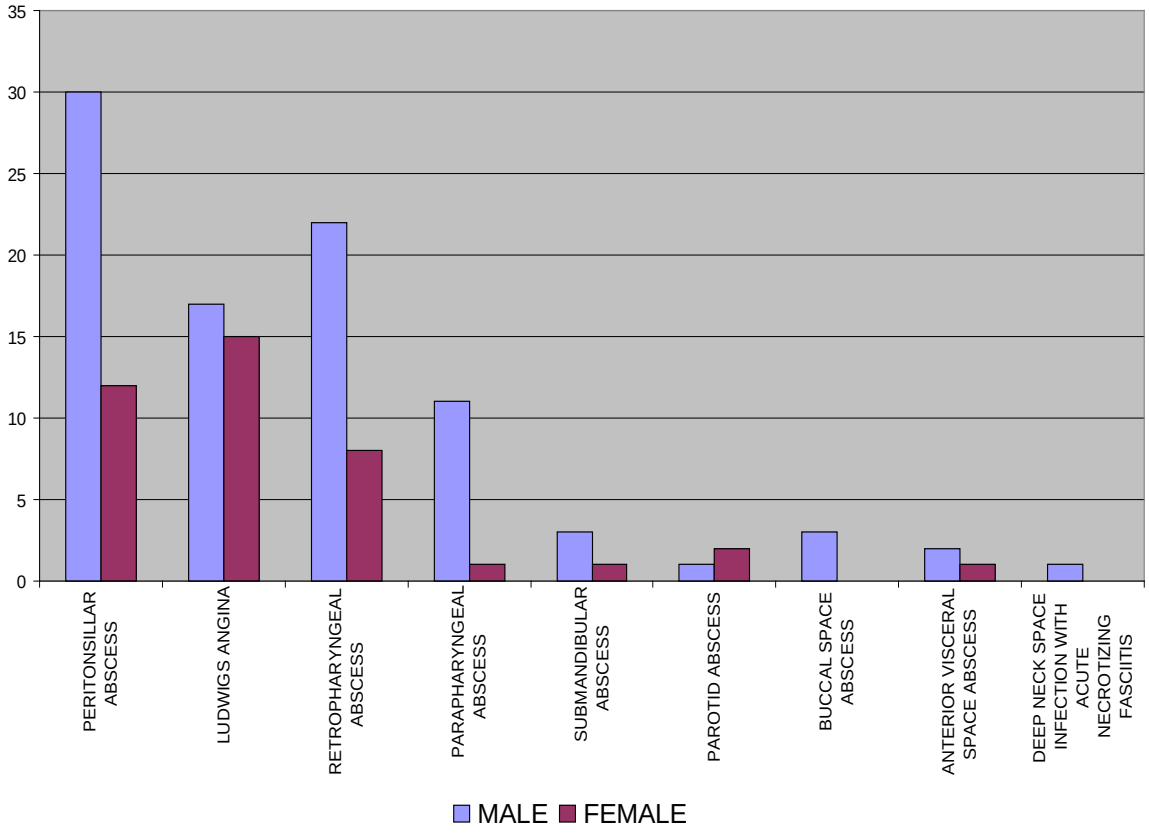
PERCENTAGE OF DEEP NECK SPACE INFECTIONS AMONG MALE & FEMALE

Tabular Column (3)

Deep neck space infections	No. of Cases	
	Male	**Female**
PERITONSILLAR ABSCESS	71 %	29 %
LUDWIG'S ANGINA	53 %	47 %
RETROPHARYNGEAL ABSCESS	73 %	27 %
PARAPHARYNGEAL ABSCESS	92 %	08 %
SUBMANDIBULAR ABSCESS	75 %	25 %
PAROTID ABSCESS	33 %	67 %
BUCCAL SPACE ABSCESS	100 %	-
ANTERIOR VISCERAL SPACE ABSCESS	67 %	33 %
DEEP NECK SPACE INFECTION WITH ACUTE NECROTIZING FASCIITIS	100 %	-

NUMBER OF MALE & FEMALE CASES IN DEEP NECK SPACE INFECTIONS

Diagram (2)

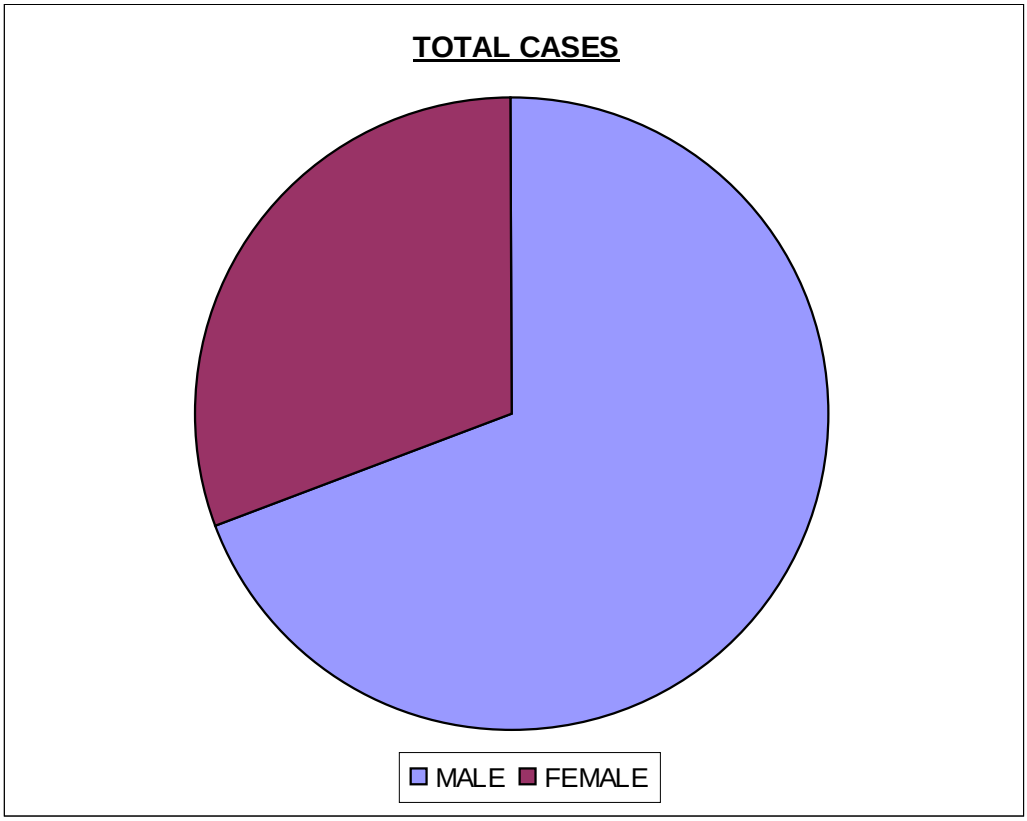


TOTAL MALE AND FEMALE CASES OF DEEP NECK SPACE INFECTIONS

Tabular Column (4)

	MALE	FEMALE
TOTAL	90	40

Diagram (3)



PERITONSILLAR ABSCESS (QUINSY)

Tabular Column (5): Number of cases in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
12 to 20	6	2
21 to 30	9	7
31 to 40	11	3
41 to 50	2	-
51 to 60	2	-
61 to 70	-	-
TOTAL	**30**	**12**

The peritonsillar abscess was more common among male and in the age group between 21yrs – 30 yrs.

LUDWIG'S ANGINA

Tabular Column (6): Number cases in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
12 to 20	1	3
21 to 30	3	2
31 to 40	1	4
41 to 50	1	2
51 to 60	9	1
61 to 70	2	3
TOTAL	**17**	**15**

Ludwig’s Angina was more common in males and in the age group between 51yrs-60 years.

Peritonsillar abscess

Ludwig’s angina

Ludwig’s *angina*

DISTRIBUTION IN MALES AND FEMALES

Diagram (4)

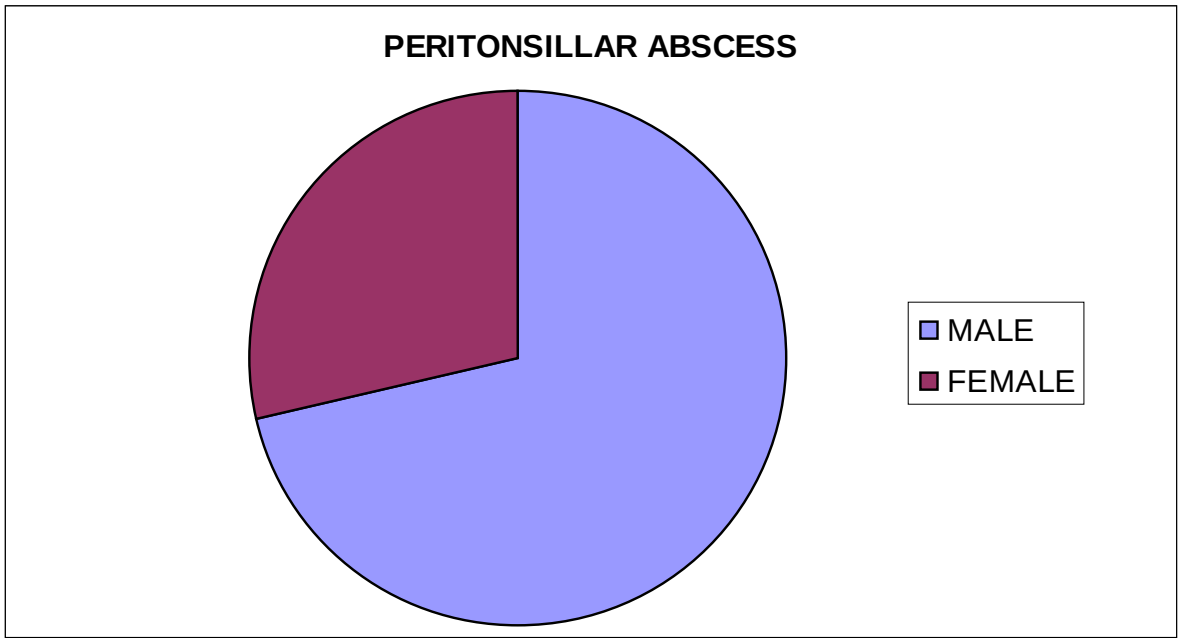
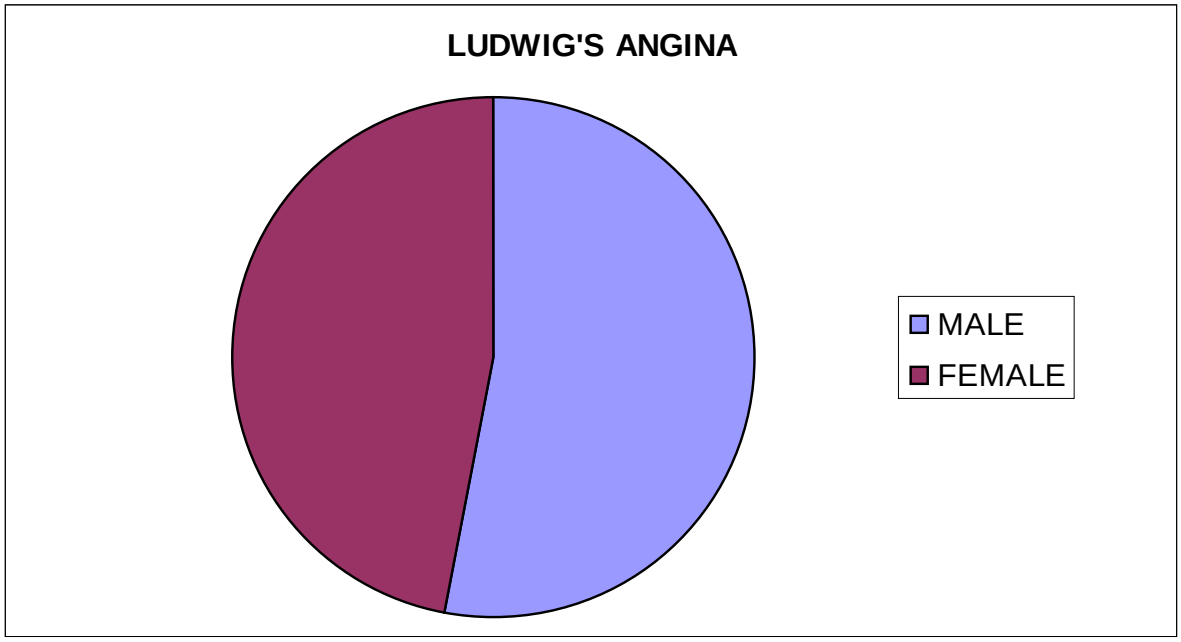


Diagram (5)



ETIOLOGY AND RISK FACTORS OF LUDWIG'S ANGINA

Tabular Column (7)

Etiology and risk factors	No. of cases
POOR ORAL HYGIENE & DENTAL CARIES	27
DIABETES MELLITUS	3
DENTAL ROOT ABSCESS	2

Dental caries and poor oral hygiene was the major cause for Ludwig’s angina .

RETROPHARYNGEAL ABSCESS

Tabular Column (8): Number of cases in males and females

AGE GROUP (in years)	No. of cases	
	Male	Female
12 to 20	-	-
21 to 30	4	-
31 to 40	5	1
41 to 50	4	5
51 to 60	5	1
61 to 70	4	1
TOTAL	**22**	**8**

Retropharyngeal abscess was common in males and in age group between 41-50yrs.

ETIOLOGY AND RISK FACTORS OF RETROPHARYNGEAL ABSCESS

Tabular Column (9)

Etiology and risk factors	No. of cases
ODONTOGENIC INFECTIONS	22
DIABETES MELLITUS	5
FOREIGN BODY	3

Retropharyngeal abscess

Retropharyngeal abscess

Retropharyngeal abscess

Retropharyngeal abscess

Diagram (6) ETIOLOGY AND RISK FACTORS OF LUDWIG'S ANGINA

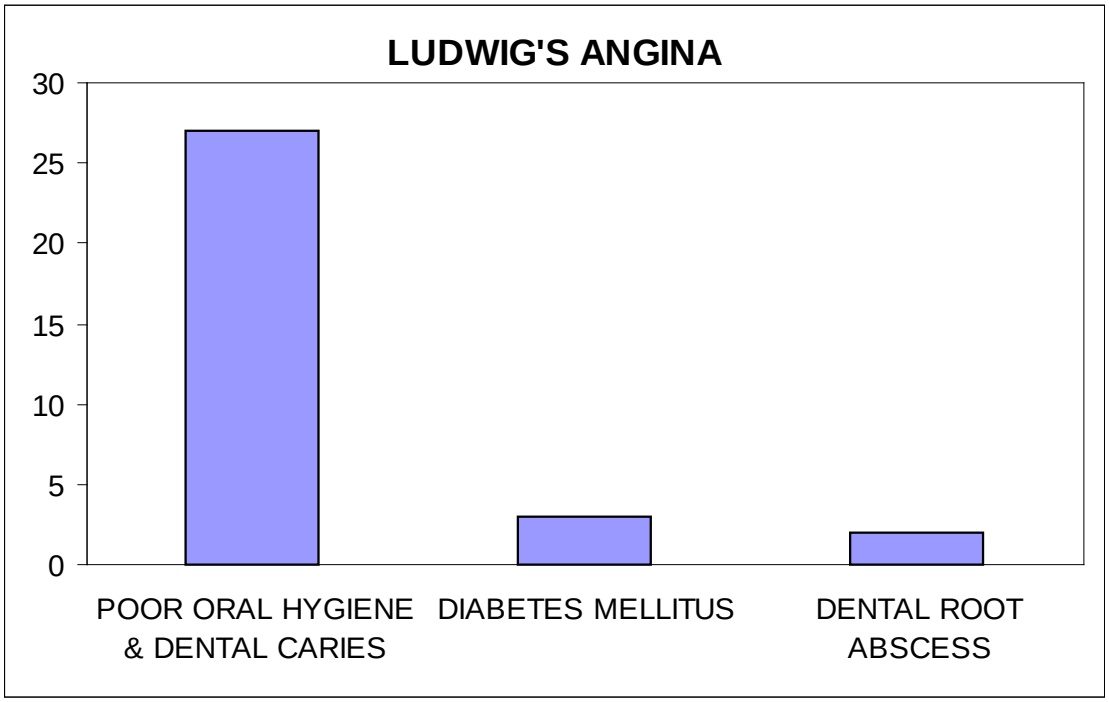
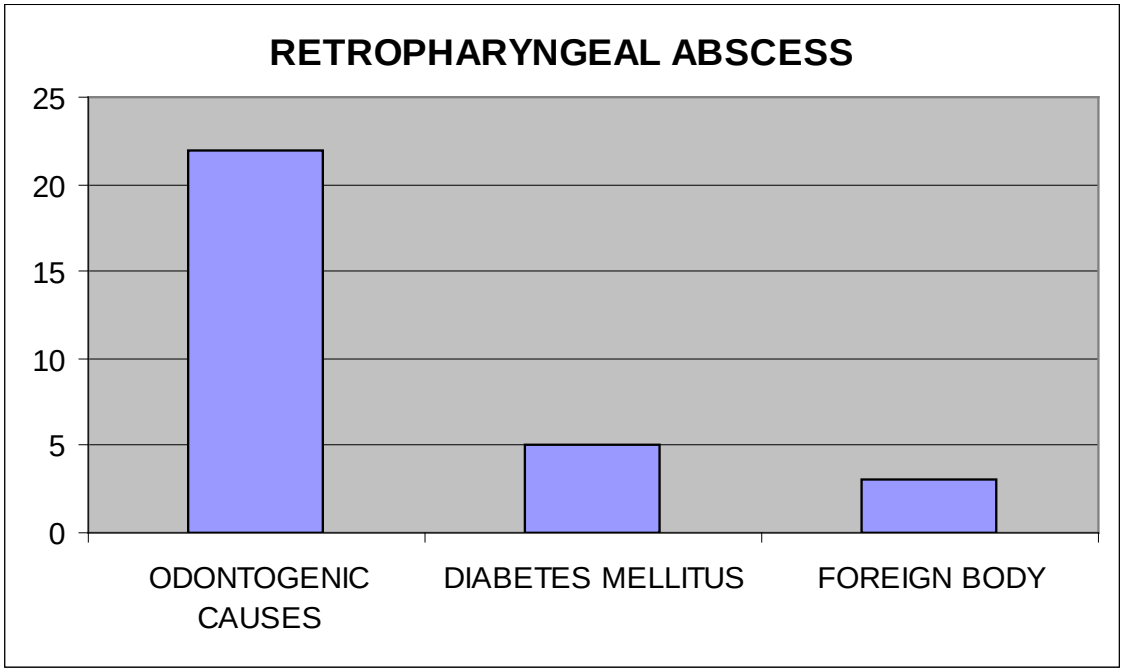


Diagram (7) ETIOLOGY AND RISK FACTORS OF RETROPHARYNGEAL ABSCESS



(Odontogenic causes – Dental caries and Poor oral hygiene)

The etiology was most commonly odontogenic infection followed by diabetes mellitus and foreign body.

Diagram (8) *DISTRIBUTION IN MALES AND FEMALES*

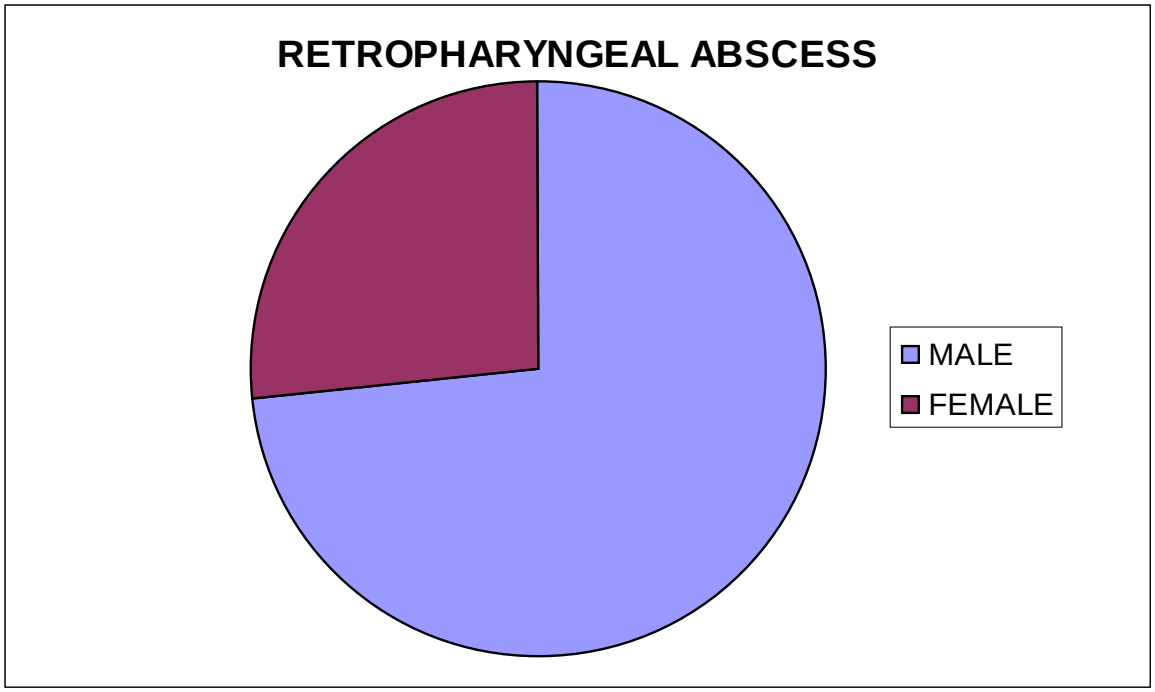
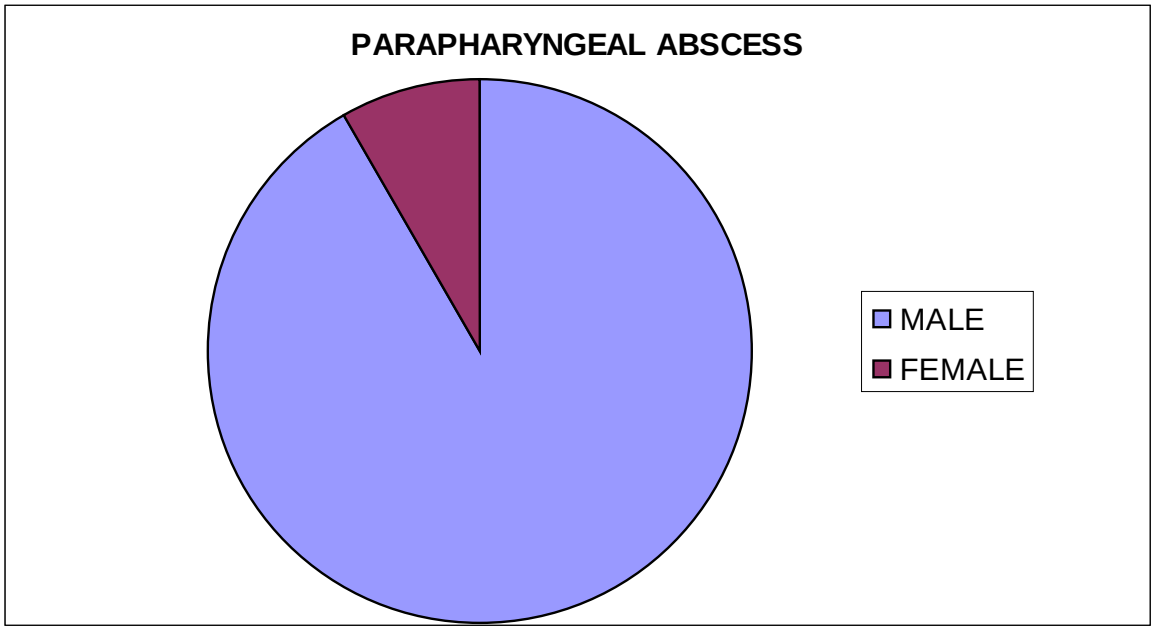


Diagram (9)



PARAPHARYNGEAL ABSCESS

Tabular Column (10): Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
12 to 20	-	-
21 to 30	3	-
31 to 40	3	-
41 to 50	2	-
51 to 60	3	1
61 to 70	-	-
TOTAL	**11**	**1**

Parapharyngeal abscess was more common in males

PAROTID ABSCESS

Tabular Column (11):Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
12 to 20	1	-
21 to 30	-	1
31 to 40	-	1
TOTAL	**1**	**2**

SUBMANDIBULAR ABSCESS

Tabular Column (12): Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
21 to 30	-	1
31 to 40	1	-
41 to 50	2	-
TOTAL	**3**	**1**

BUCCAL ABSCESS

Tabular Column (13):Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
21 to 30	-	-
31 to 40	2	-
41 to 50	1	-
TOTAL	**3**	**0**

ANTERIOR VISCERAL SPACE INFECTION

Tabular Column (14):Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
21 to 30	-	1
31 to 40	1	-
41 to 50	1	-
TOTAL	**2**	**1**

DEEP NECK SPACE INFECTION WITH ACUTE NECROTIZING FASCIITIS

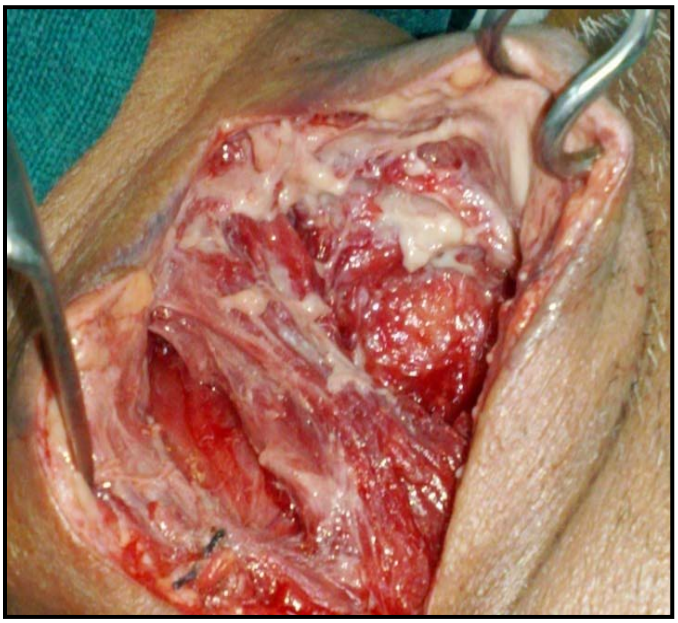
Tabular Column (15):Distribution in males and females

Age Group (in years)	No. of Cases	
	Male	**Female**
DEEP NECK SPACE INFECTION WITH ACUTE NECROTIZING FASCIITIS 41 to 50yrs	**1**	**-**

Buccal Space infection

Anterior visceral space abscess

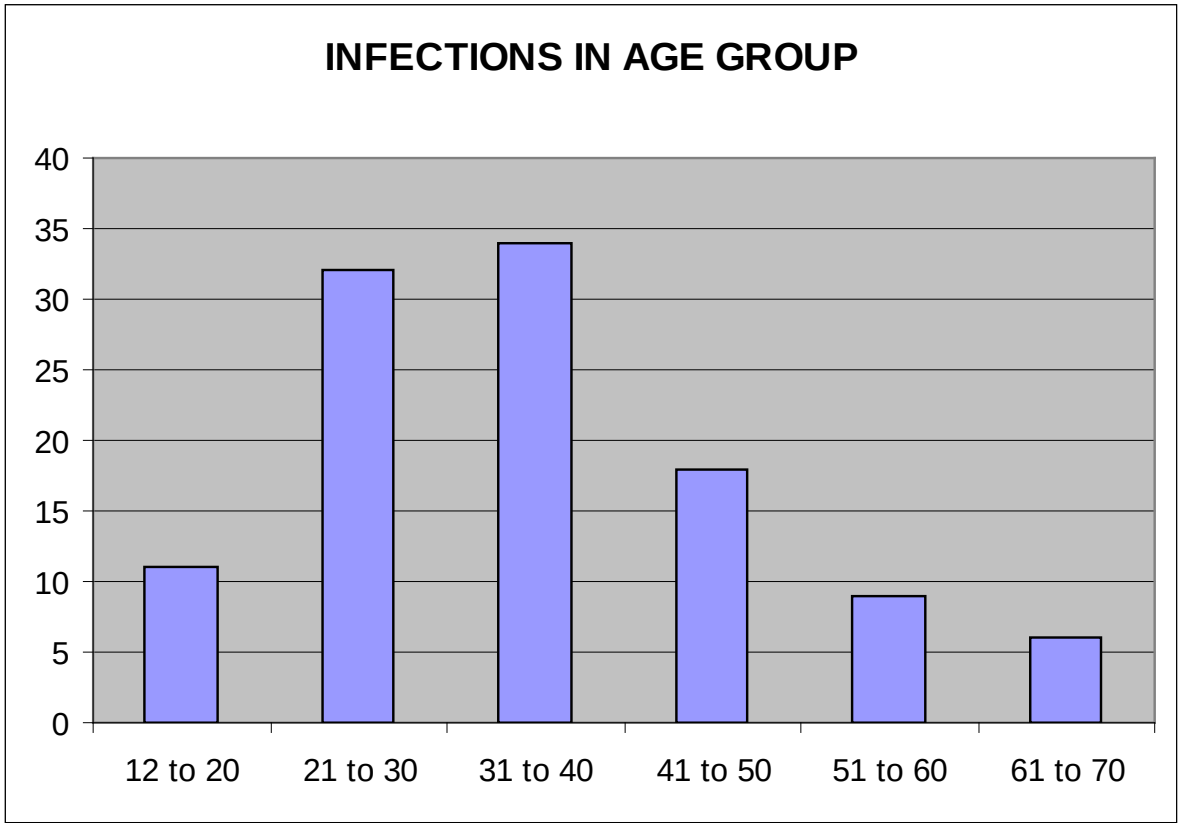
Acute necrotizing cervical fasciitis



Acute necrotizing cervical fasciitis on exploration

INFECTIONS IN AGE GROUP

Diagram (10)



In this present study of deep neck space infection the age group between 31-40 years shows maximum number of cases(of 34 cases) and minimum number of cases in the age group between 61-70 years.

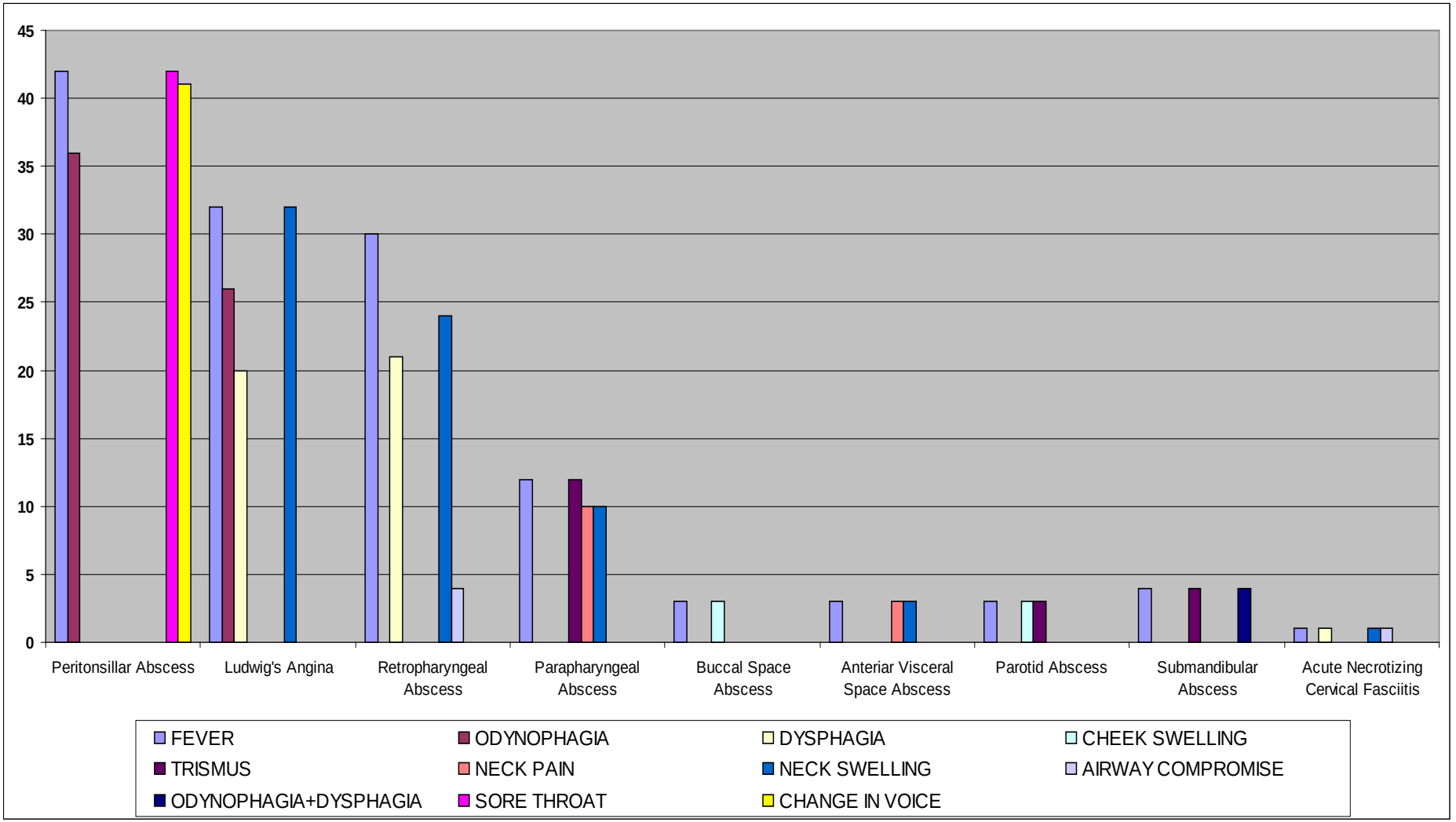
MOST COMMON CLINICAL FEATURE

Tabular Column (16)

	Peritonsillar Abscess	**Ludwig's Angina**	**Retropharyngeal Abscess**	**Parapharyngeal Abscess**	**Buccal Space abscess**	**Anterior Visceral Space Abscess**	**Parotid Abscess**	**Submandibular Abscess**	**Acute Necrotizing Fasciitis**
FEVER	✓ (42)	✓ (32)	✓ (30)	✓ (12)	✓ (3)	✓ (3)	✓ (3)	✓ (4)	✓ (1)
ODYNOPHAGIA	✓ (36)	✓ (26)							
DYSPHAGIA		✓ (20)	✓ (21)						✓ (1)
CHEEK SWELLING					✓ (3)		✓ (3)		
TRISMUS				✓ (12)			✓ (3)	✓ (4)	
NECK PAIN			(5)	✓ (10)		✓ (3)			(1)
NECK SWELLING		✓ (32)	✓ (24)	✓ (10)		✓ (3)			✓ (1)
AIRWAY COMPROMISE			✓ (4						✓ (1)
ODYNOPHAGIA+DYSPHAGIA								✓ (4)	
SORE THROAT	✓ (42)								
CHANGE IN VOICE	✓ (41)								

CLINICAL FEATURES

Diagram (11)



DIAGNOSTIC TOOL

Tabular Column (17)

X-RAY NECK (including lateral soft tissue) and CHEST	130
CULTURE AND SENSITIVITY OF ASPIRATE	130
COMPUTED TOMOGRAPHY SCAN	90

All cases had x-ray neck , x-ray chest and culture and sensitivity of the aspirate. Patient with retropharyngeal, parapharyngeal and anterior visceral space abscess had computed tomography scan done to evaluate the size of abscess and involvement of other spaces and to look for impending airway compromise.

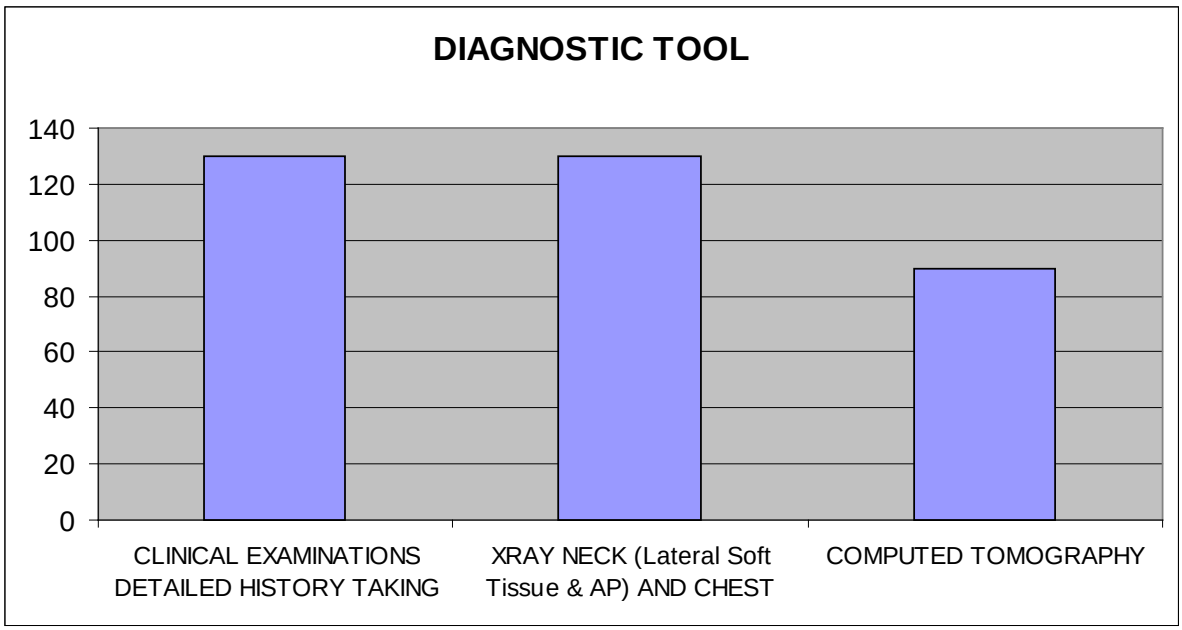
ETIOLOGY AND RISK FACTORS FOR DEEP NECK SPACE INFECTIONS

Tabular Column (18)

CHRONIC PHARYNGITIS	40
DENTAL CARIES & POOR DENTAL HYGIENE	82
DENTAL ROOT ABSCESS	1
DIABETES MELLITUS	2
TRAUMA	1
FOREIGN BODY	4
TOTAL	**130**

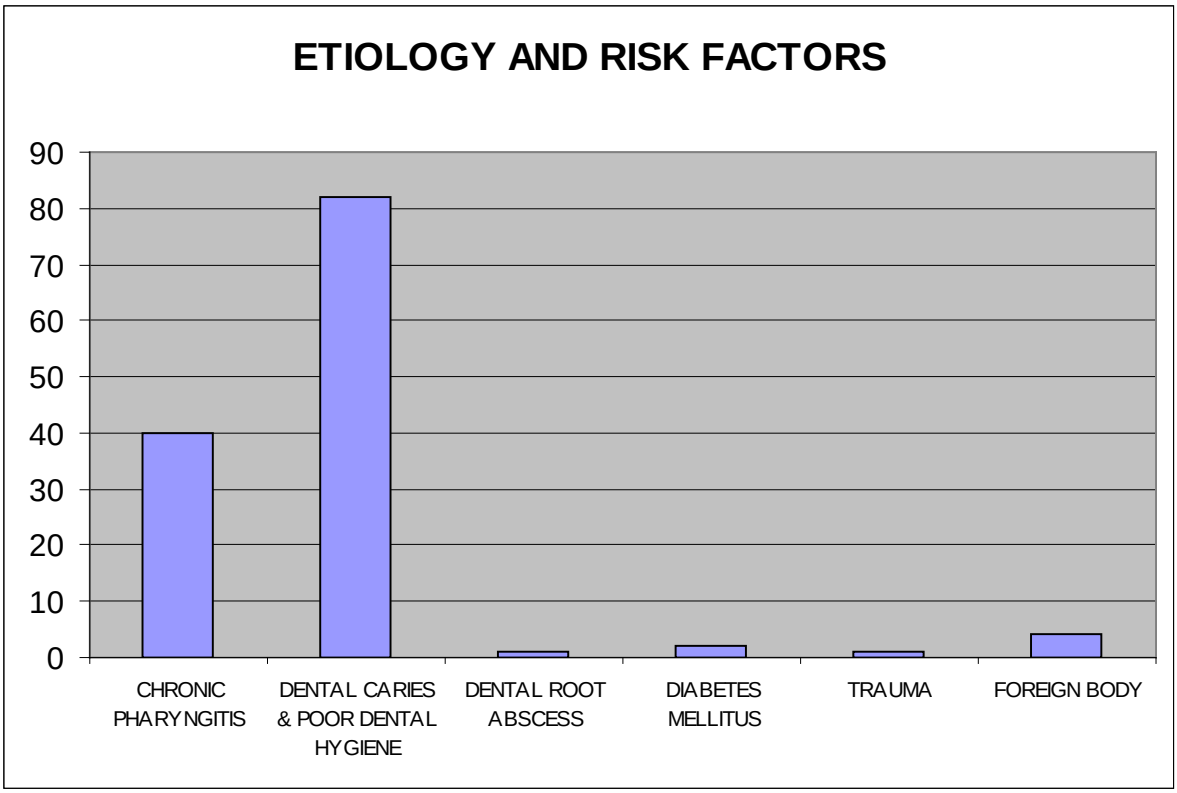
Odontogenic infections was the commonest etiology for deep neck space infections among the 130 cases.

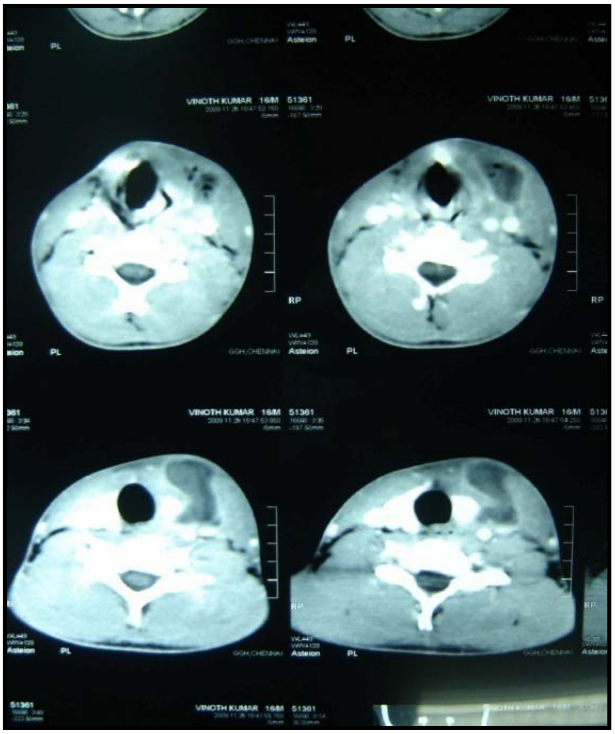
Diagram (12)



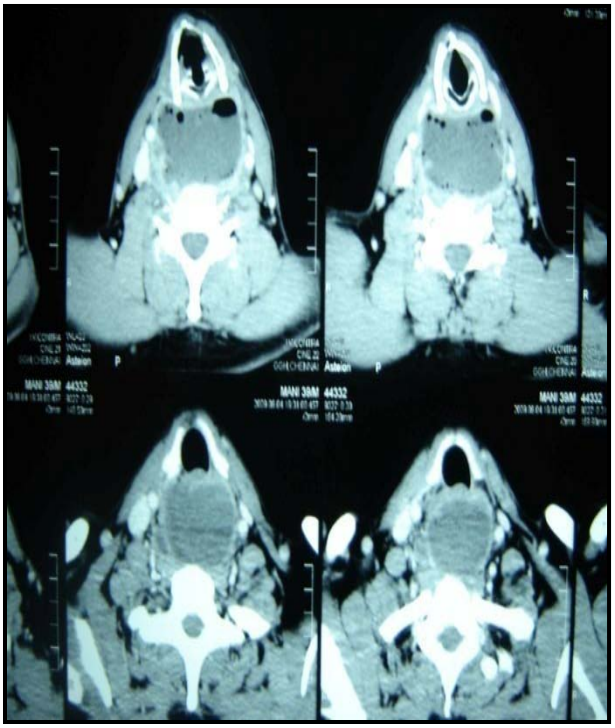
All the case had culture and sensitivity of the aspirates for specific and sensitive antibiotic coverage. Other investigations based on clinical presentation and spaces involved.

Diagram (13)

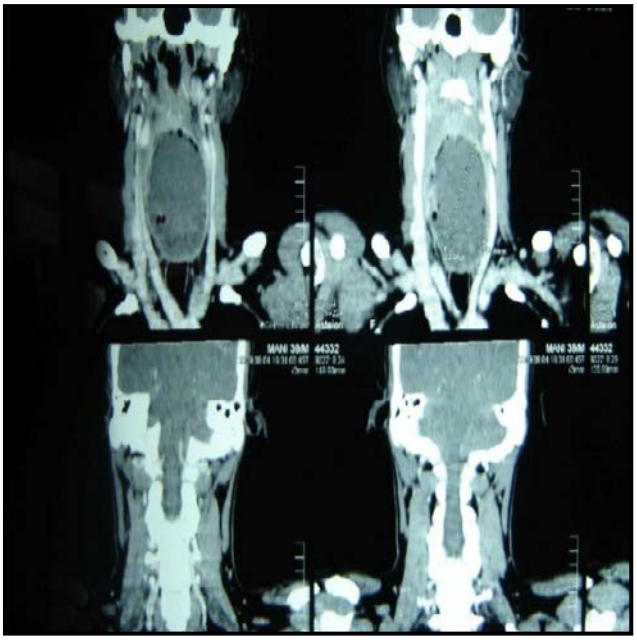




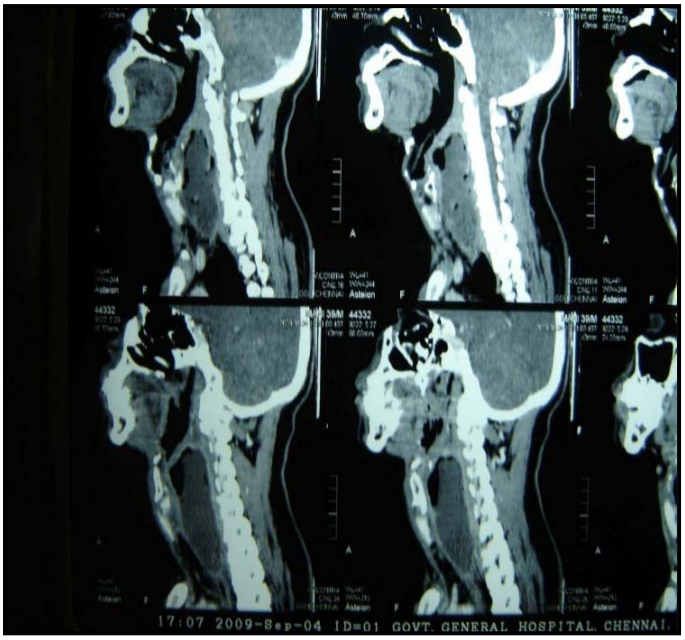
Anterior Visceral space infection abscess



Retropharyngeal



Retropharyngeal abscess



Retropharyngeal abscess

MOST COMMON ORGANISM IN DEEP NECK SPACE INFECTIONS

Tabular Column (19)

STREPTOCOCCUS SPECIES (PYOGENES & PNEUMONIAE)	30
STAPHYLOCOCCUS AUREUS	34
COAGULASE NEGATIVE STAPHYLOCOCCUS AUREUS	22
KLEBSIELLA PNEUMONIAE	19
METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS	9
GRAM NEGATIVE ORGANISMS (E.coli-6,proteus-6)	12
NO GROWTH	4
TOTAL	**130**

Staphylococcus Aureus was the commonest organism causing deep neck space infection.

ANTIBIOTIC USED BASED ON CULTURE & SENSITIVITY OF ASPIRATE

Tabular Column (20)

CEFOTAXIME	11
CIPROFLOXACIN	9
METRONIDAZOLE	14
CEFOPERAZONE SULBACTUM	19
AMIKACIN	7
CEFOTAXIME + METRONIDAZOLE + GARAMYCIN	70

In the present study the combination of drugs was given more commonly based on culture and sensitivity of aspirate.

Diagram (14)

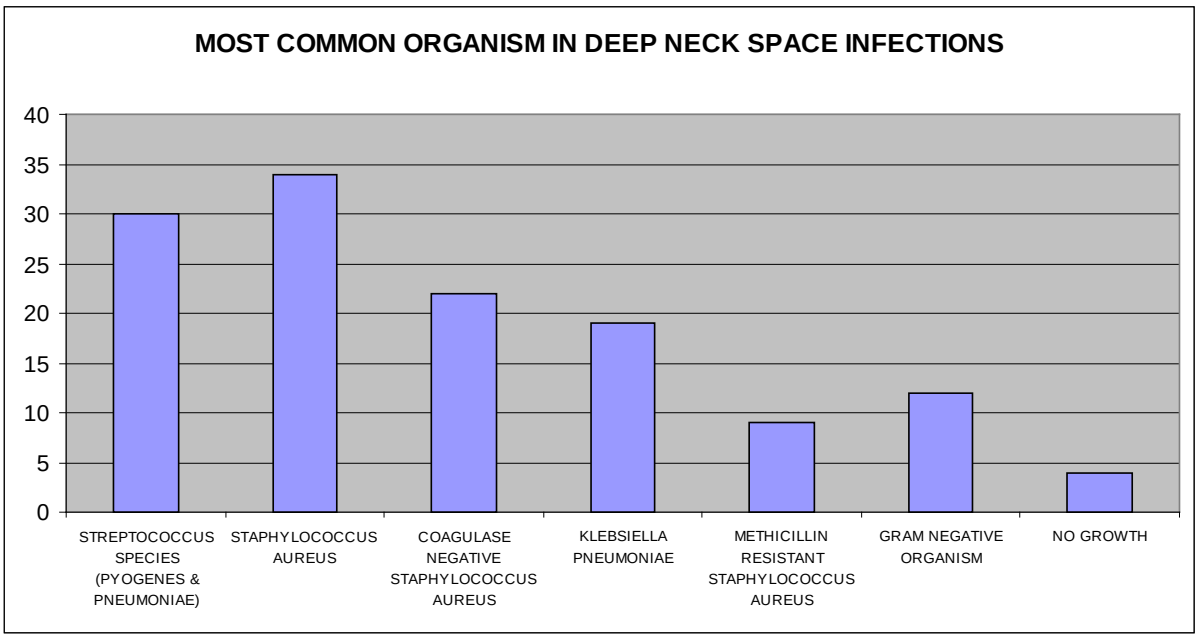
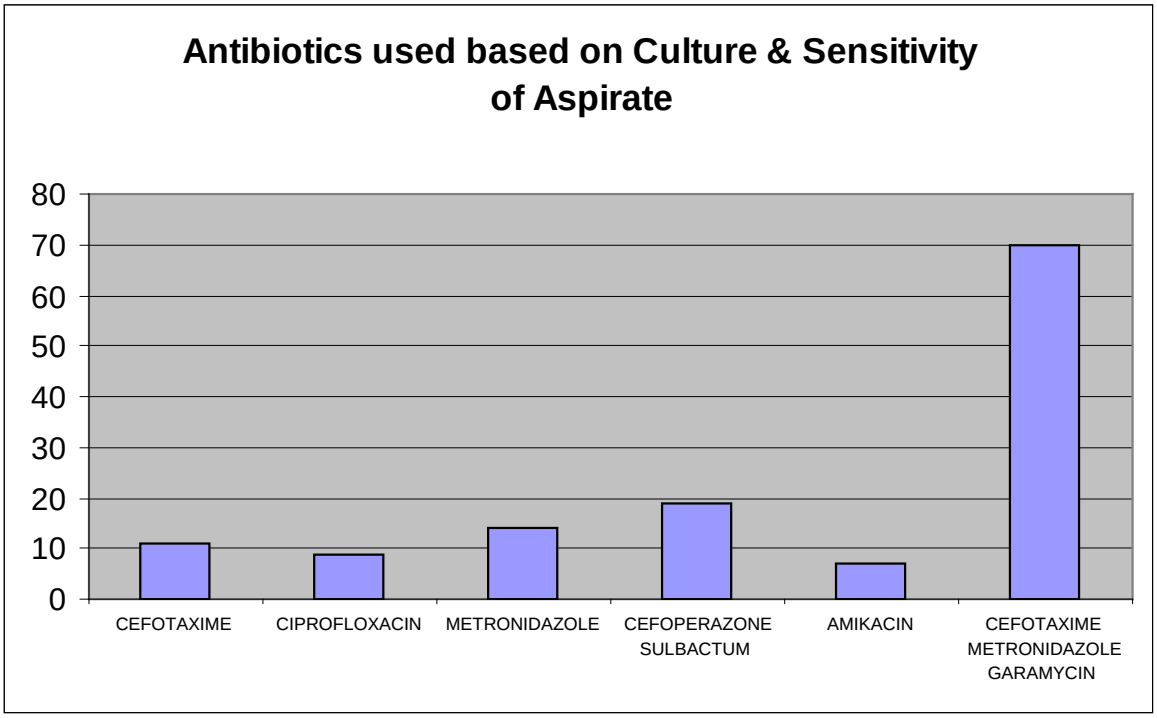


Diagram (15)



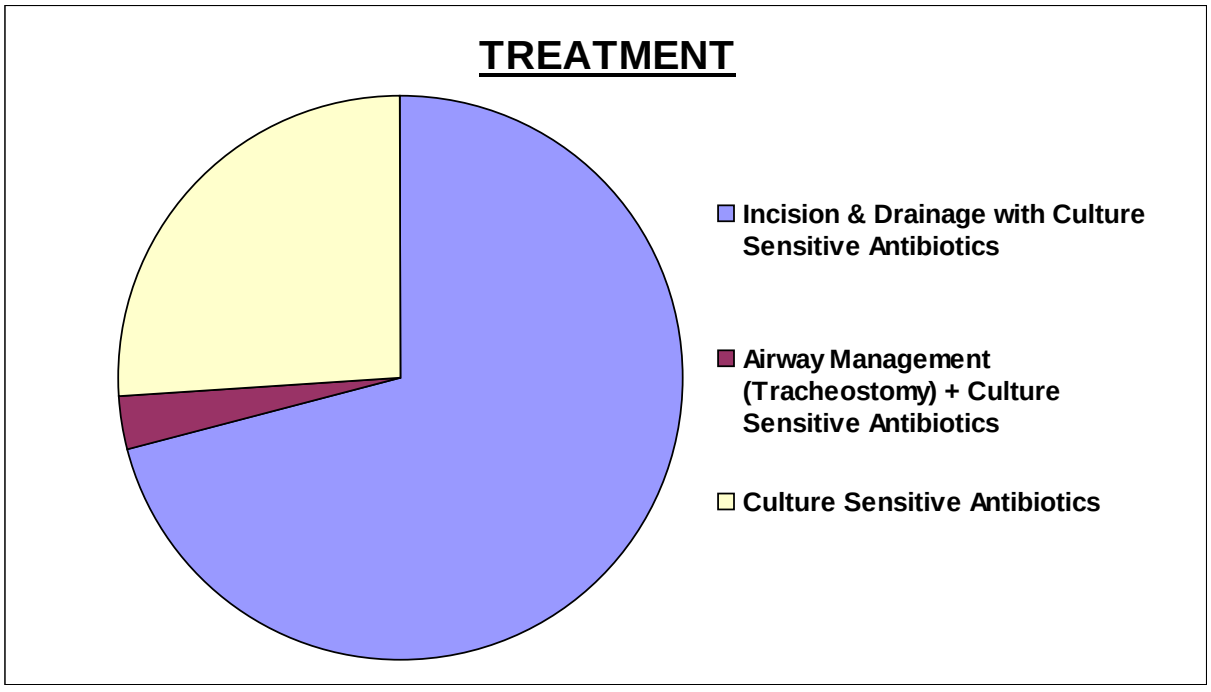
TREATMENT

Tabular Column (21)

Incision and Drainage followed by culture sensitive antibiotics	92
Airway Management (Tracheostomy)	4
Culture sensitive antibiotics	34
TOTAL CASES	**130**

Among 130 cases, 92 cases had incision and drainage for peritonsillar abscess, retropharyngeal abscess, parotid abscess, anterior visceral space abscess, acute necrotizing fasciitis and few cases of parapharyngeal abscess. Remaining 34 cases were treated by culture sensitive antibiotics. Among 130 cases, 4 cases had airway compromise and underwent tracheostomy.

Diagram (16)



DISCUSSION

Tabular Column (22) PERITONSILLAR ABSCESS:

STUDY	PERITONSILLAR ABSCESS
PLAZA MAYOR (2001) [45]	36%
PRESENT STUDY (2007 – 2009)	33 %

In the present study the predominant deep neck space infection was peritonsillar abscess and it is the same as the previous study. The etiology was chronic pharyngitis.

PERITONSILLAR ABSCESS PREVALENCE AMONG AGE GROUPS

Tabular Column (23)

STUDY	FEMALE (in Years)	MALE (in years)
MARTINEZ SAN MILLAN.J (2001) [45]	11 – 20	21 – 30
PRESENT STUDY (2007 – 2009)	21 – 30	31 – 40

In the present study, the prevalent age group for peritonsillar abscess was between 11 yrs - 20 yrs for females and between 31 yrs - 40 yrs for males.

Tabular Column (24) LUDWIG'S ANGINA:

STUDY	PERCENTAGE	AGE GROUPS
MARIE STAUTON AND GRIFFIN (2001) [45]	34 %	21 – 30
PRESENT STUDY (2007 – 2009)	25 %	51 - 60

In the present study, Ludwig's Angina was more prevalent in the age group between 51 yrs – 60 yrs and forms 25% of deep neck space infection.

In the previous study, it forms 34% of deep neck space infections and prevalent age group was between 21 yrs – 30 yrs.

Tabular Column (25) ETIOLOGY OF PARAPHARYNGEAL SPACE INFECTION:

STUDY	ETIOLOGY OF PARAPHARYNGEAL SPACE INFECTION
SICHEL (2006) [12]	ODONTOGENIC AND PHARYNGEAL INFECTION
THE PRESENT STUDY(2007-2009)	ODONTOGENIC (Dental Caries) AND PHARYNGEAL INFECTION

In the present study, odontogenic and pharyngeal infections were the etiological factors for the parapharyngeal space infections and it was the same result in the previous study by Sichel (2006).

Tabular Column (26)

STUDY	ORGANISM	RISK FACTORS
BROOK (2004) [46]	STAPHYLOCOCCUS AUREUS	ODONTOGENIC INFECTION
PRESENT STUDY(2007-2009)	STAPHYLOCOCCUS AUREUS	DENTAL CARIES & ODONTOGENIC INFECTION

In the previous study, organism most commonly involved was Staphylococcus aureus. In the present study also Staphylococcus aureus was the commonest organism isolated from culture. The result was same when compared with previous study.

Tabular Column (27)

STUDY	TOTAL CASE	INCIDENCE OF MEDIASTINITIS IN ANTERIOR VISCERAL SPACE INFECTION
BOSCOLO RIZZO (2006) [19]	6	5
PRESENT STUDY(2007 - 2009)	3	1

In the study by Boscolo-Rizzo majority of cases of anterior visceral space infections had mediastinitis as the life threatening complication, 5 cases had mediastinitis out of 6 cases.

In the present study of the 3 cases of anterior visceral space infections one case had mediastinitis.

Tabular Column (28) ***MANAGEMENT:***

STUDY	MANAGEMENT
BROOK (2004) [5]	PENICILLIN + METRONIDAZOLE.
PRESENT STUDY(2007-2009)	Most Cases – Incision And Drainage Followed By CEFOTAXIME + METRONIDAZOLE + GARAMYCIN

In the previous study most of the cases were treated by Penicillin with Metronidazole. In the present study most of the cases were treated by incision and drainage followed by combination of intravenous antibiotics, Cefotaxime, Metronidazole and Garamycin(based on culture and sensitivity of aspirate).

Tabular Column (29) ***AIRWAY MANAGEMENT:***

STUDY	TRACHEOSTOMY PERFORMED
HAR-EL (1994) & PARHISCAR (2001) [1,22]	75 %
PRESENT STUDY(2007-2009)	3 %

In Har-El (1994) and Parhiscar (2001) study, 75% of the Ludwig's angina cases had Tracheostomy for the airway compromise and in the present study only 3% of the case underwent Tracheostomy. Totally 4 cases had Tracheostomy for airway compromise.

SUMMARY

Deep neck space infections are life threatening infections of the head and neck region .Wide spread use of antibiotics has lowered the life threatening infections and also altered their clinical presentation. Rapid spread of infection from one space to another space results in increased incidence of complication.

In the present study of 130 cases of deep neck space infections,the diagnosis was established based on detailed clinical history, accurate clinical examination, laboratory investigations and radiological examination .

In 130 cases of deep neck space infections, 69% of patients were males, 31% of patients were females. Infection were common in males . Among the deep neck space infections the most common was peritonsillar abscess (33%). Remaining infections were Ludwig's angina (25%), retropharyngeal abscess (23%) , parapharyngeal abscess (9%) , submandibular abscess (3%) , parotid abscess (3%) , buccal abscess (3%), anterior visceral space abscess (3%) and deep neck space infections with acute necrotizing fasciitis (1%) .

All the cases presented with fever and most of the cases with sore throat and dysphagia. Other clinical features were odynophagia, trismus, neck pain, neck swelling, change in voice, cheek swelling and remaining features based on the spatial compartments involved.

The most common etiology for deep neck space infections was odontogenic infection followed by chronic pharyngitis. Based on the investigations most of the patients in this study were treated by incision and drainage followed by antibiotics based on culture and sensitivity of the aspirate. The most commonest organism was staphylococcus aureus followed by streptococcus pyogenes and pneumoniae. Most of the patients in this study were treated by combination of antibiotics like cefotaxime, metronidazole and garamycin followed by dental opinion . The age group most commonly involved were between 31 yrs – 40 yrs. Conservative treatment was done by culture directed antibiotics .Surgical treatment involved incision and drainage, If there are signs of impending airway obstrucion tracheostomy was performed.

CONCLUSION

Deep neck space infections can be a potential life threatening complication of common head and neck diseases .Early diagnosis, appropriately prescribed antibiotics and surgical drainage remains the important line of treatment .

- The common etiological factors were odontogenic infections followed by pharyngitis and tonsillitis .
- Age group between 31 yrs and 40 yrs were most commonly affected.
- It was more common in males.
- The most common clinical features were fever, neck swelling and neck pain and the other clinical features presented depending on the spatial compartments involved .
- Staphylococcus aureus was the most commonest organism causing deep neck space infection followed by streptococcus species.
- Gold standard investigation was computed tomography scan.
- Baseline management was with conservative treatment involving culture directed antibiotics .
- Surgical treatment involved incision and drainage followed by culture directed antibiotics and tracheostomy when there is impending or established airway obstruction .
- Supportive measures like observation , intravenous fluids and stabilising the general condition of the patient are important for better results.
- Enteral feeding with nasogastric tube to improve the nutritional status gives early recovery.

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PROFORMA

Name : IP / OP No. :

Age : Sex :

Occupation :

Address :

Presenting Complaints :

History of presenting illness

S. No.	Complaints	Yes	No	Duration
1.	Fever			
2.	Fever with chills			
3.	Sore throat			
4.	Tongue pushed back			
5.	Neck pain			
6.	Neck stiffness			
7.	Ear pain			
8.	Neck Swelling			
9.	Change in Voice			
10.	Body ache			
11.	Painful swallowing			
12.	Difficulty in Swallowing			
13.	Difficulty in breathing			
14.	Difficulty in talking			
15.	Noisy difficulty in breathing			
16.	Cough with expectoration			
17	Chest Pain			

Past History : Diabetes Mellitus / Tuberculosis / Hypertension / Epilepsy / Jaundice / Asthma

Personal History : Diet, Appetite, Smoking, Alcohol, Tobacco Chewer, Bladder and Bowel habits.

Family History : Married / Unmarried :

Number of Children :

Socioeconomic Status : Low ☐ Middle ☐ High ☐

General Examinations:

Appearance :

Temperature :

Pallor :

Cyanosis :

Jaundice :

Pedal edema :

Lymphadenopathy :

Thyroid Swelling :

Pulse	Blood Pressure	Respiratory Rate	Temperature

Systemic Examination:

Cardiovascular system	Respiratory system
Examination of abdomen	Central nervous system

Local Examination:

<u>Throat:</u>

ORAL CAVITY ;

Lips :

Teeth :

Gingivo buccal sulcus and labial sulcus:

Oral Mucosa :

Tongue anterior 2/3rd of tongue :

Floor of mouth :

Hard and soft palate :

Retromolar Trigone :

OROPHARYNX ;

Tonsils and pillars :

Posterior pharyngeal wall and lateral Pharyngeal wall :

Indirect Laryngoscopy:

Posterior 1/3 rd of Tongue :

Vallecula :

Epiglottis :

Aryepiglottic folds :

Arytenoids :

Ventricular Bands :

Both Vocal cords and mobility :

Subglottis :

Hypopharyngx : Posteriorpharyngeal wall

Pyriform fossa

Postcricoid region

Neck:

Inspection

Skin :

Laryngeal contour :

Thyroid :

Tracheal Position :

Abnormal Veins, Sinus, Scar :

Laryngeal crepitus :

Palpation

Warmth :

Tenderness :

Nodes :

Carotid Pulsations :

Ear **:** Right ☐ Left ☐

Tympanic Membrane :

External Auditory Canal. :

Nose **:**

Cranial nerves **:**

<u>Investigations:</u>

Blood	:	Hb	:
		TC	:
		DC	:
		ESR	:
		Platelet	:
		aPTT	:
		PT	:
		BT & CT	:
Urine	:	Albumin	:
		Sugar	:

Throat Swab Culture and sensitivity :

Culture and sensitivity of aspirate :

X-ray Chest :

X-ray Neck AP / Lateral :

X-ray Neck Soft Tissue AP / Lateral :

Computed tomography scan :

Patient Name :

Diagnosis :

Procedure :

Anaesthesia : GA / LA

Positions :

Final Diagnosis :

ABBREVIATIONS

DNI	-	Deep Neck space Infections
PTA	-	Peritonsillar Abscess
RPA	-	Retropharyngeal Abscess
LA	-	Ludwig's angina
BSI	-	Buccal space Infections
PPA	-	Parapharyngeal abscess
LT	-	Laryngeal Trauma
AVSA	-	Anterior Visceral space abscess
I & D	-	Incision and Drainage
A & C	-	Antibiotic & Conservative Management
SMA	-	Submandibular Abscess
ASP	-	Aspirations
DSI	-	Danger Space infection
ANF	-	Acute Necrotizing cervical Faciitis
A	-	Antibiotics
FB	-	Foreign Body
FR	-	Foreign Body removal
F	-	Fever
Od	-	Odynophagia
CS	-	Cheek swelling

D	-	Dysphagia
T	-	Trismus
NP	-	Neck pain
NS	-	Neck swelling
A	-	Airway compromise
ST	-	Sore throat
C	-	Change in voice
SA	-	Staphylococcus aureus
SP	-	Streptococcus species
CONS	-	Coagulase negative staphylococcus aureus
KP	-	Klebsiella pneumonia
MRSA	-	Methicillin resistant staphylococcus aureus
NO	-	No growth
PA	-	Parotid abscess
EC	-	E.coli
P	-	Proteus

MASTER CHART

S. No	Name	Age	Sex	I.P. No.	Diagnosis	Clinical Feature										C/S	Treatment	
						F	Od	D	CS	T	NP	NS	AC	ST	C		Medical	Surgery
1.	Sathya	17	F	27391	LA	+	-	+	-	-	-	+	-	-	-	NO	A	
2.	Shanthi	38	F	34430	PTA	+	+	-	-	-	-	-	-	+	-	SA	A	I&D
3.	Logeshwari	14	F	34433	PTA	+	-	-	-	-	-	-	-	+	+	EC	A	I&D
4.	Vijaya	26	F	38551	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
5.	Latha	30	F	52996	PTA	+	-	-	-	-	-	-	-	+	+	SA	A	I&D
6.	Shanthi	40	F	8733	PTA	+	-	-	-	-	-	-	-	+	+	SP	A	I&D
7.	Radha	22	F	867	PTA	+	+	-	-	-	-	-	-	+	+	NO	A	I&D
8.	Kumari	45	F	11957	LA	+	+	+	-	-	-	+	-	-	-	MR SA	A	
9.	Vijay	13	M	14446	PA	+	-	-	+	+	-	-	-	-	-	SP	A	I&D
10.	Jothy	25	F	38743	PA	+	-	-	+	+	-	-	-	-	-	SP	A	I&D
11.	Rajeshwari	35	F	51057	LA	+	+	+	-	-	-	+	-	-	-	KP	A	
12.	Banu	45	F	81590	RPA	+	-	-	-	-	-	-	-	-	-	MR SA	A	I&D

13.	Divya	15	F	1267	LA	+	-	+	-	-	-	+	-	-	-	P	A	
14.	Manjula	37	F	4709	LA	+	+	+	-	-	-	+	-	-	-	SA	A	
15.	Devi	25	F	4659	SMA	+	-	-	-	+	-	-	-	-	-	EC	A	I&D
16.	Sundari	34	F	17079	RPA	+	-	+	-	-	-	-	-	-	-	SA	A	I&D
17.	Jayalakshmi	38	F	35473	LA	+	-	+	-	-	-	+	-	-	-	NO	A	
18.	Savithri	22	F	40344	AVSA	+	-	-	-	-	+	+	-	-	-	MR SA	A	I&D
19.	Jayanthi	28	F	51597	PTA	+	-	-	-	-	-	-	-	+	+	SA	A	I&D
20.	Janaki	33	F	70949	PA	+	-	-	+	+	-	-	-	-	-	SP	A	I&D
21.	Sudha	22	F	40225	LA	+	+	+	-	-	-	+	-	-	-	SP	A	
22.	Mani	34	M	38931	PTA	+	-	-	-	-	-	-	-	+	+	P	A	I&D
23.	Prabhu	21	M	49809	PTA	+	-	-	-	-	-	-	-	+	+	SP	A	I&D
24.	Mohan	25	M	69240	LA	+	-	+	-	-	-	+	-	-	-	NO	A	
25.	Senthil	21	M	79323	RPA	+	-	-	-	-	-	+	-	-	-	KP	A	I&D
26.	Raju	43	M	80307	BSI	+	-	-	+	-	-	-	-	-	-	SP	A	I&D

27.	Chellamuthu	50	M	11019	RPA	+	-	-	-	-	-	-	-	-	-	SA	A	I&D
28.	Elumalai	39	M	12259	PPA	+	-	-	-	+	-	-	-	-	-	EC	A	
29.	Jayabal	57	M	13013	LA	+	+	+	-	-	-	+	-	-	-	SP	A	
30.	Hariharan	25	M	22111	RPA + FB	+	-	+	-	-	+	+	-	-	-	SA	A	I&D FBR
31.	Shankar	33	M	23981	RPA + FB	+	-	+	-	-	+	+	-	-	-	SA	A	I&D FBR
32.	Gopu	55	M	35830	RPA with acute epiglottitis	+	-	+	-	-	-	-	+	-	-	KP	A	I&D
33.	Dilli raja	57	M	39008	PPA	+	-	-	-	+	+	+	-	-	-	SA	A	
34.	Rajamohan	35	M	64525	LA	+	-	+	-	-	-	+	-	-	-	SP	A	
35.	Ali	52	M	36049	PTA	+	+	-	-	-	-	-	-	+	+	P	A	I&D
36.	Murugan	38	M	88038	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
37.	Pugalendi	25	M	95341	RPA	+	-	-	-	-	-	-	-	-	-	SA	A	I&D
38.	Sundararam	54	M	5113	RPA	+	-	-	-	+	-	-	-	-	-	SP	A	I&D
39.	Devaraj	48	M	18643	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
40.	Murugan	48	M	31982	RPA+FB	+	-	+	-	-	+	+	-	-	-	CONS	A	I&D FBR

41.	Seetharaman	47	M	54166	PPA	+	-	-	-	+	+	+	-	-	-	SA	A	
42.	Kesavan	62	M	63968	RPA	+	-	-	-	-	-	-	-	-	-	SA	A	I&D
43.	Natarajan	55	M	65198	LA	+	-	-	-	-	-	+	-	-	-	CONS	A	
44.	Siva	38	M	86702	BSI	+	-	-	+	-	-	-	-	-	-	CONS	A	I&D
45.	Ethiraj	47	M	33184	LA	+	+	-	-	-	-	+	-	-	-	KP	A	
46.	Ganesan	37	M	61602	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
47.	Murugan	35	M	21876	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
48.	Boopathy	60	M	48139	LA	+	+	-	-	-	-	+	-	-	-	KP	A	
49.	Arumugam	52	M	55964	RPA	+	-	-	-	-	-	+	-	-	-	SA	A	I&D
50.	Govindasamy	37	M	81869	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
51.	Kumar	55	M	86419	RPA	+	-	+	-	-	-	+	-	-	-	SA	A	I&D
52.	Raj	17	M	19690	PTA	+	+	-	-	-	-	-	-	+	+	EC	A	I&D
53.	Mohan	40	M	43507	PPA	+	-	-	-	+	+	+	-	-	-	SA	A	
54.	Ramesh	22	M	88597	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
55.	Shafi	27	M	72068	PPA	+	-	-	-	+	+	+	-	-	-	SA	A	

56.	Raji	55	F	33942	RPA	+	-	+	-	-	-	+	-	-	-	SA	A	I&D
57.	Jaya	42	F	42691	RPA	+	-	+	-	-	-	-	-	-	-	P	A	I&D
58.	Dhanalakshmi	40	F	67611	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
59.	Munirathnam	60	M	60098	LA with dental root abscess	+	+	+	-	-	-	+	-	-	-	MR SA	A	I&D
60.	Mohammed Mosthappa	30	M	31714	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
61.	Eansan	37	M	61602	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
62.	Siva	38	M	86792	BSI	+	-	-	+	-	-	-	-	-	-	SP	A	I&D
63.	Boopathy	60	M	48139	LA	+	+	+	-	-	-	+	-	-	-	KP	A	I&D
64.	Iyyanar	27	M	53618	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
65.	Govindasamy	37	M	81869	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
66.	Annadurai	33	M	86782	PTA	+	+	-	-	-	-	-	-	+	+	EC	A	I&D
67.	Dinesh kumar	26	M	25828	RPA	+	-	+	-	-	-	+	-	-	-	MR SA	A	I&D
68.	Kuppan	28	M	24863	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
69.	Eswari	31	F	23723	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
70.	Kumari	28	F	49643	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D

71.	Iya Arbutharaj	34	M	74175	PPA	+	-	-	-	+	+	+	-	+	+	SP	A	I&D
72.	Subramani	50	M	75491	PTA	+	+	-	-	-	-	-	-	+	+	CONS	A	I&D
73.	Ameer Hussain	15	M	95116	PTA	+	+	-	-	-	-	-	-	+	+	CONS	A	I&D
74.	Velu	65	M	1305	RPA+FB	+	-	+	-	-	+	+	-	-	-	CONS	A	I&D FBR
75.	Babu	20	M	3856	LA	+	+	-	-	-	-	+	-	-	-	KP	A	
76.	Raja	35	M	28741	RPA	+	-	-	-	-	-	+	-	-	-	P	A	I&D
77.	Krishnan	56	M	65656	SMA	+	-	-	-	+	-	+	-	-	-	MRSA	A	I&D
78.	Vengaiyan	35	M	80558	PPA	+	-	-	-	+	+	+	-	-	-	KP	A	
79.	Thiruettai	57	M	88563	RPA	+	-	+	-	-	-	+	+	-	-	SA	A	I&D
80.	Jayavelu	55	M	48922	LA	+	+	+	-	-	-	+	-	-	-	KP	A	I&D
81.	Vadivelu	55	M	47036	LA	+	+	-	-	-	-	+	-	-	-	EC	A	
82.	Rathinam	43	M	81071	PPA	+	-	-	-	+	+	+	-	-	-	SA	A	
83.	Saravanan	35	M	63872	SMA	+	-	-	-	+	-	+	-	-	-	CONS	A	I&D
84.	Paneerselvam	37	M	39460	RPA	+	-	-	-	-	-	+	-	-	-	SA	A	I&D
85.	Rathinasamy	70	M	25194	RPA	+	-	+	-	-	-	+	-	-	-	KP	A	I&D
86.	Murugan	35	M	19720	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D

87.	Shanmugam	67	M	24653	LA	+	+	-	-	-	-	+	-	-	-	CONS	A	
88.	Jayabal	55	M	17126	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
89.	Lakshmanan	53	M	85604	LA	+	+	+	-	-	-	+	-	-	-	KP	A	
90.	Gopal	26	M	14224	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
91.	Chandrasekar	54	M	88448	LA	+	+	-	-	-	-	+	-	-	-	KP	A	
92.	Kumar	55	M	86419	RPA	+	-	+	-	-	+	+	-	-	-	SA	A	I&D
93.	Raji	17	F	19690	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
94.	Mohan	40	M	43507	RPA	+	-	-	-	-	-	+	-	-	-	CONS	A	I&D
95.	Parimala	45	F	51011	RPA	+	-	+	-	-	-	+	-	-	-	SA	A	I&D
96.	Malliga	69	F	65486	LA	+	+	-	-	-	-	+	-	-	-	CONS	A	I&D
97.	Seetha	17	F	69952	LA	+	+	+	-	-	-	+	-	-	-	SA	A	
98.	Maragatham	55	F	84844	LA	+	+	-	-	-	-	+	-	-	-	KP	A	
99.	Sagunthala	47	F	88608	RPA	+	-	+	-	-	-	+	-	-	-	SA	A	I&D
100.	Rajamadulla	27	M	59679	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
101.	Ilayaperumal	27	M	71496	PTA	+	+	-	-	-	-	-	-	+	+	CONS	A	I&D

102.	Kuyyramma	40	F	5831	LA	+	+	+	-	-	-	+	-	-	-	CONS	A	I&D
103.	Usha	25	F	82140	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
104.	Sakthivel	26	M	89452	PPA	+	-	-	-	+	+	+	-	-	-	P	A	
105.	Ramasamy	45	M	85492	AVSA	+	-	-	-	-	+	+	-	-	-	MRSA	A	I&D
106.	Kanniyappan	25	M	39218	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
107.	Asvathamma	45	M	70661	RPA	+	-	+	-	-	-	+	-	-	-	KP	A	I&D
108.	Subramani	29	M	61200	LA	+	+	-	-	-	-	+	-	-	-	CONS	A	
109.	Ellaiyan	70	M	17969	RPA	+	-	+	-	-	-	+	-	-	-	CONS	A	I&D
110.	Krishnan	48	M	17322	SMA	+	-	-	-	+	-	-	-	-	-	KP	A	I&D
111.	Vinoth kumar	35	M	3633	AVSA	+	-	-	-	-	+	+	-	-	-	MRSA	A	I&D
112.	Eswari	27	F	89339	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
113.	Muthammal	65	F	82753	LA	+	+	+	-	-	-	+	-	-	-	CONS	A	
114.	Gnanasoundari	59	F	72493	PPA	+	-	-	-	+	+	+	-	-	-	CONS	A	
115.	Vijayalakshmi	45	F	64295	RPA	+	-	+	-	-	-	+	-	-	-	KP	A	I&D
116.	Ranjitha	13	F	56273	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
117.	Rukmani	70	F	77000	LA	+	+	-	-	-	-	+	-	-	-	KP	A	

118.	Yashoda	60	F	83049	RPA	+	-	+	-	-	-	+	-	-	-	CONS	A	I&D
119.	Amudha	44	F	87197	LA	+	+	-	-	-	-	+	-	-	-	CONS	A	
120.	Sudha	30	F	71350	LA	+	+	-	-	-	-	+	-	-	-	SA	A	
121.	Nagalingam	57	M	65790	PPA	+	-	-	-	+	+	+	-	-	-	CONS	A	
122.	Mannar	42	M	48960	RPA	+	-	+	-	-	-	+	-	-	-	CONS	A	I&D
123.	Elumalai	30	M	89706	PPA	+	-	-	-	+	+	+	-	-	-	KP	A	
124.	Vignesh	12	M	60405	PTA	+	+	-	-	-	-	-	-	+	+	SP	A	I&D
125.	Balan	45	M	58690	DNI+ ANF	+	-	+	-	-	+	+	+	-	-	MR SA	A	I&D
126.	Nagaraj	18	M	89559	PTA	+	+	-	-	-	-	-	-	-	-	SA	A	I&D
127.	Rathinam	70	M	89078	LA	+	+	+	-	-	-	+	-	+	+	KP	A	
128.	Mani	39	M	37690	RPA	+	-	+	-	-	-	+	+	-	-	CONS	A	I&D
129.	Kalaiarasan	13	M	89060	PTA	+	+	-	-	-	-	-	-	+	+	SA	A	I&D
130.	Kumaresan	26	M	78609	LA	+	+	+	-	-	-	+	-	-	-	CONS	A	

INSTITUTIONAL ETHICAL COMMITTEE
MADRAS MEDICAL COLLEGE,CHENNAI-600 003.

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L.Dis.No. 14597/ME5/EthicsDean/MMC/2009 Dated .09.2009

Title of the work : "The study on deep neck space infections"
Principal Investigator : Dr. C.R.K. Balaji . P.G - MS (ENT)
Department : Madras medical college, chennai-3.

The request for an approval from the Institutional Ethical Committee(IEC) was considered on the IEC meeting held on 23rd September 2009 at 2.00P.M. in Madras Medical College, Deans, Chamber, Chennai-3. Pharmacology seminar hall. Madras medical college ch-3

The members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The principal investigator and their term are directed to adhere the guidelines given below:

1. You should get detailed informed consent from the patients/participants and maintain confidentiality.
2. You should carry out the work without detrimental to regular activities as well as without extra expenditure to the Institution or Government.
3. You should inform the IEC in case of any change of study procedure, site and investigation or guide.
4. You should not deviate form the area of the work for which I applied for ethical clearnance.
5. You should inform the IEC immediately, in case of any adverse events or serious adverse reactions.
6. You should abide to the rules and regulations of the institution(s).
7. You should complete the work within the specific period and if any extension of time is required, you should apply for permission again and do the work.
8. You should submit the summary of the work to the ethical committee on completion of the work.
9. You should not claim funds from the Institution while doing the work or on completion.
10. You should understand that the members of IEC have the right to monitor the work with prior intimation.

SECRETARY
IEC, MMC,CHENNAI

CHAIRMAN
IEC, MMC CHENNAI

24/09/09

DEAN
MADRAS MEDICAL COLLEGE
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